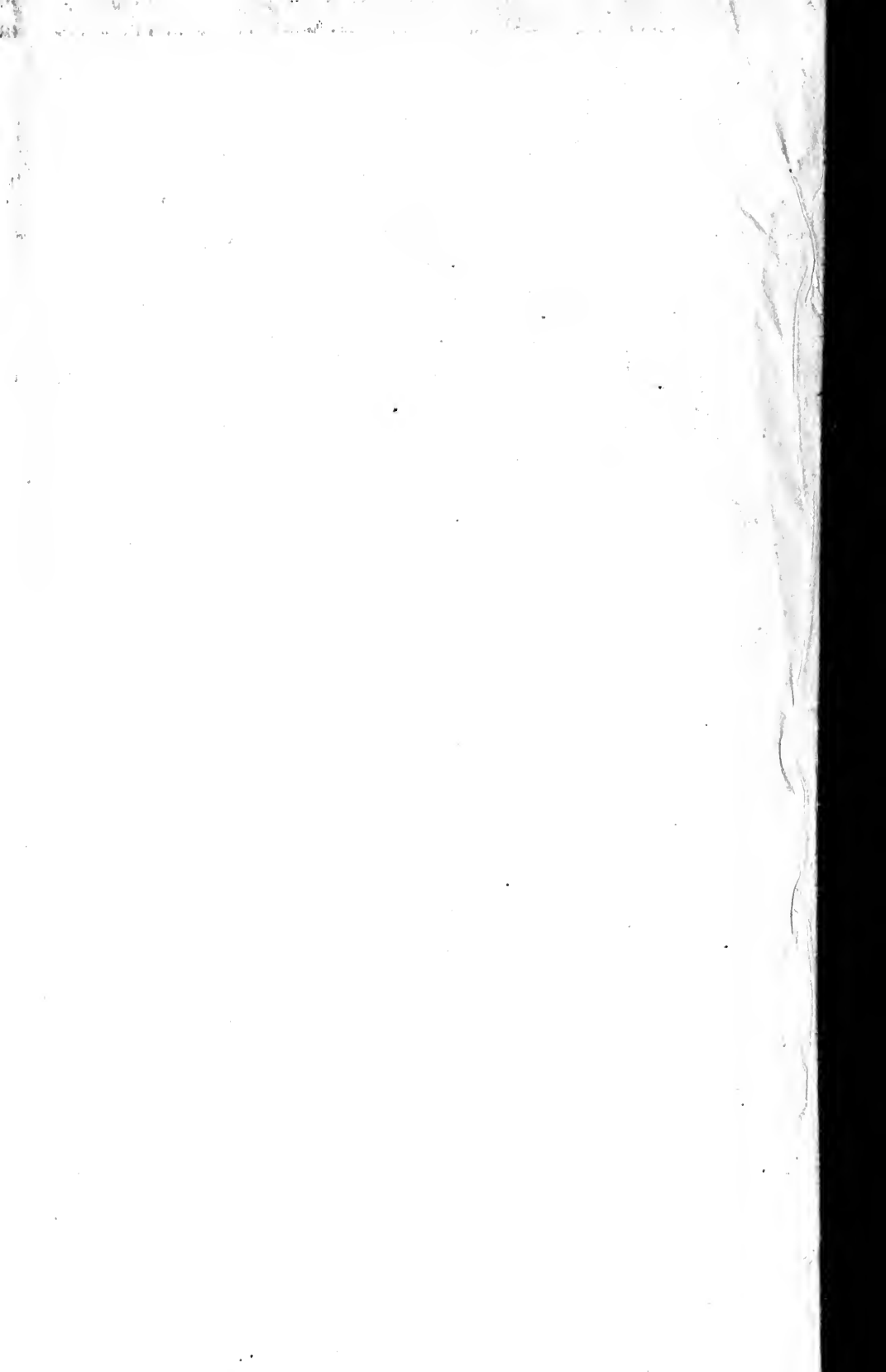
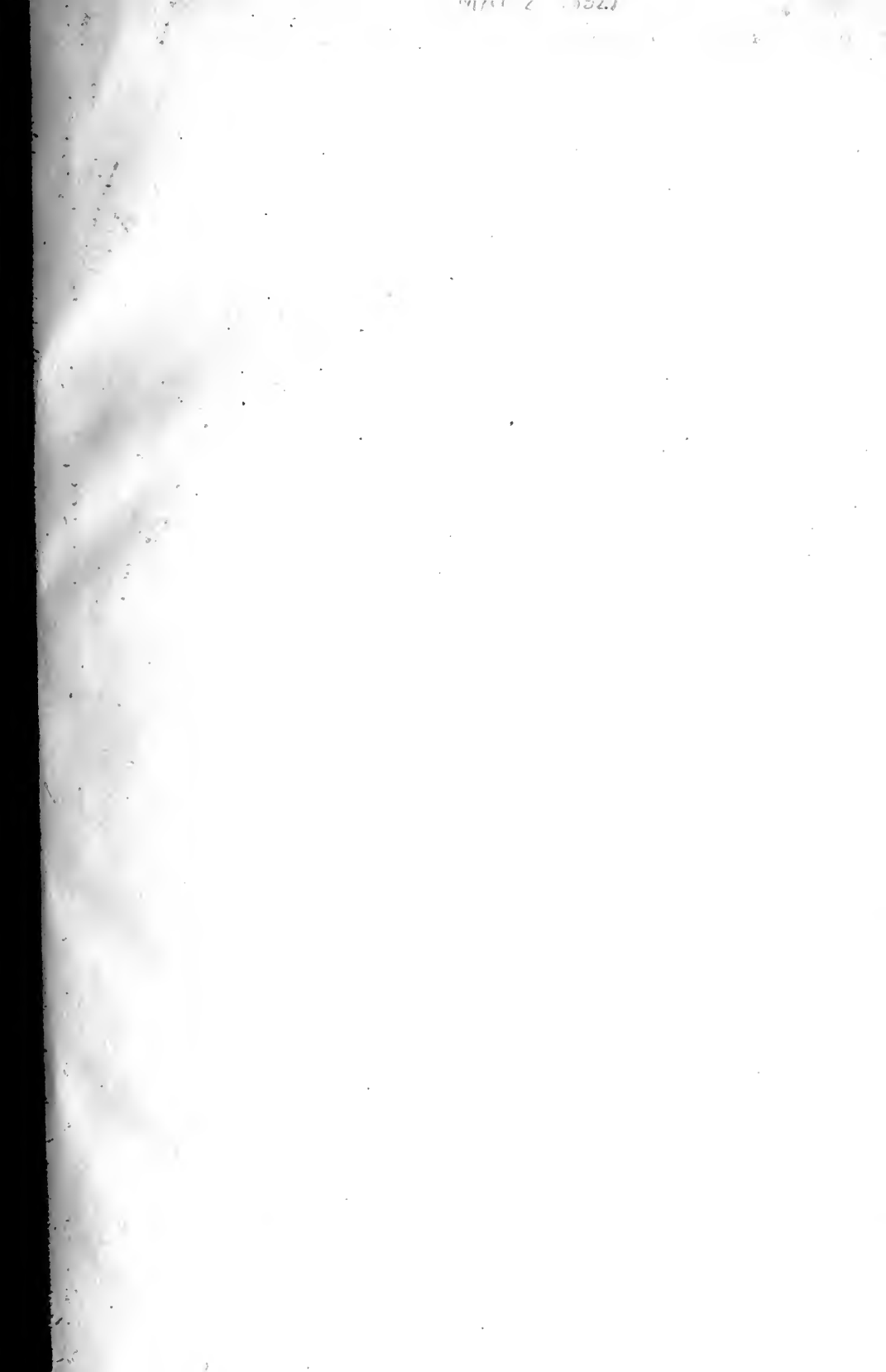


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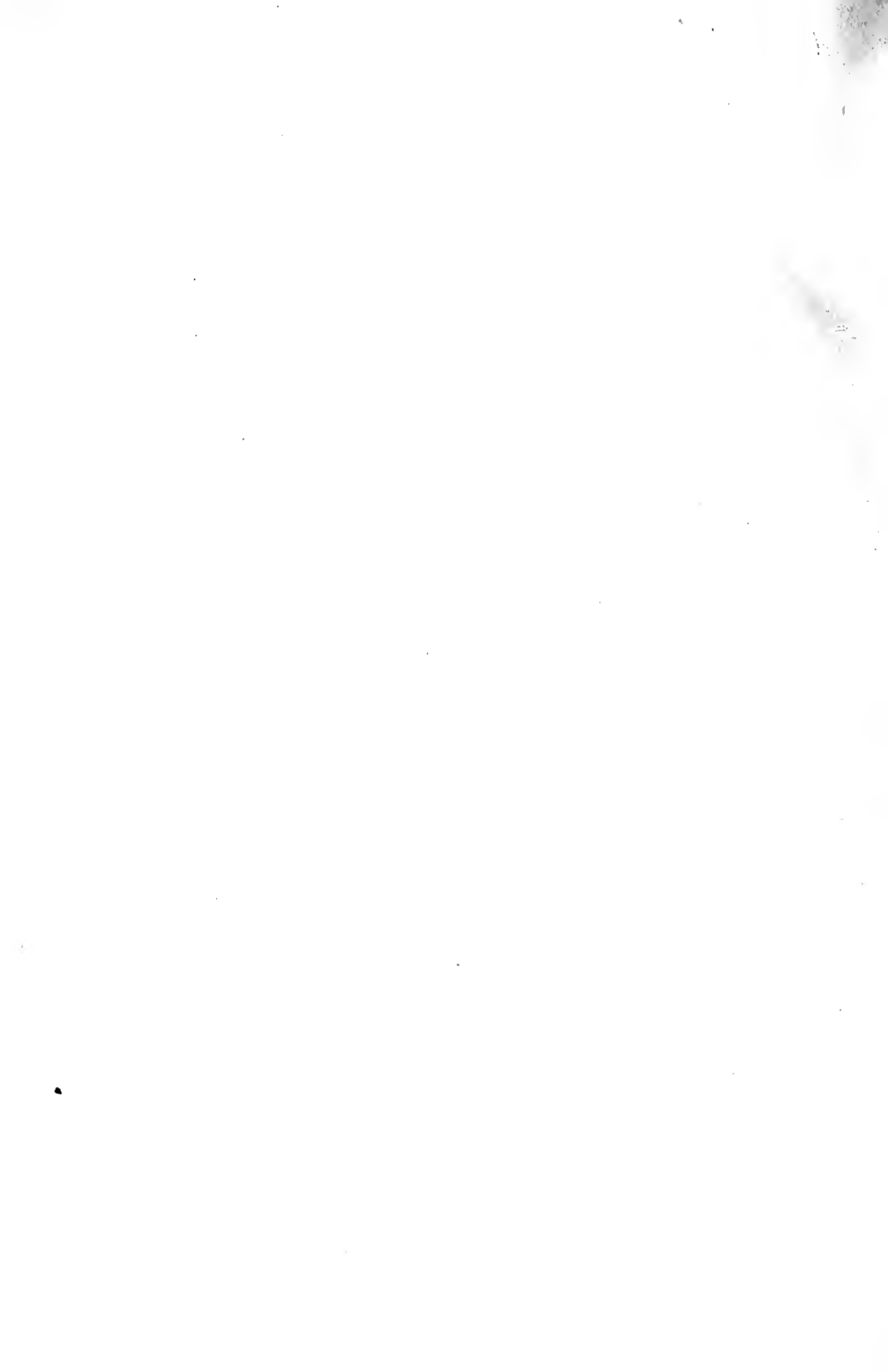












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# ARCHIVES OF PEDIATRICS

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# ARCHIVES OF PEDIATRICS

JANUARY, 1921

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## ORIGINAL COMMUNICATIONS

### INFLUENZAL MENINGITIS.\*

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Meningitis, due to the Pfeiffer bacillus and usually called influenza meningitis, seems to have been definitely established as a clinical entity by Slawyk<sup>1</sup> in 1899, the bacteriological work being supervised by no less an authority than Pfeiffer himself. Earlier cases, due to gram negative bacilli, were reported by Pfuhl<sup>2</sup>, Haedke<sup>3</sup> and Fraenkel<sup>4</sup>, but the bacteriological findings have been questioned. Though the disease is far from common, a fairly large number of cases have been reported. It ranks fourth in our experience among the types of purulent meningitis.

\*From the Research Laboratory, Department of Health, New York City. Read before the Section on Medicine, New York Academy of Medicine, November 4, 1920.

Table I shows the incidence of the different forms of purulent meningitis among the cases of meningeal involvement that have been studied by the Meningitis Division during the past 10 years.

TABLE I—Cases of Purulent Meningitis.

Epidemic Cerebrospinal Meningitis.....	541
Pneumonic Meningitis .....	61
Streptococcic Meningitis .....	49
Influenzal Meningitis .....	32
Staphylococcic Meningitis .....	9
Total .....	692

The cases of influenzal meningitis that have been reported and collected by various workers are given in Table II.

The cases reported by Simon, Wollstein, Torrey and Stone represent reports collected from the literature in addition to their own cases. So far as I have been able to determine, there are no duplications. The cases credited to Koplik, Dunn, and the Meningitis Division were seen by the workers in question.

Dr. Wollstein made a careful study of the published reports and from these, in addition to her own investigations, concluded that in the majority of fatal cases a general blood infection occurs. She also pointed out that the development of influenzal meningitis is frequently preceded by otitis, rhinitis, clinical "influenza," or other involvement of the respiratory tract.

In our series of cases, the diagnosis was made by finding in the spinal fluid the gram negative hemoglobinophilic bacillus, described by Pfeiffer. In smears from the spinal fluid these bacilli show a high degree of pleomorphism, a fact observed by several other workers. An interesting point was brought out by Dr. Povitzky, of the Research Laboratory (to be published), who found that 4 out of 7 strains from cases of influenzal meningitis belonged by agglutination to the same type. On the other hand, the strains isolated from the respiratory tract during the epidemic of influenza, so-called, showed only a slight tendency to fall into groups when studied by Miss Valentine and Miss Cooper.<sup>11</sup>

It is, of course, only by the bacteriological study of the spinal fluid that the diagnosis of influenzal meningitis can be made during life, as there is nothing in the history, the clinical picture of the case, or the other characteristics of the spinal fluid to dis-



tinguish it from other forms of purulent meningitis. Indeed, from a clinical standpoint, the disease is especially liable to escape diagnosis, since so large a proportion of the cases are found in infants in whom the diagnosis of meningitis is generally most difficult. It is evidently a disease of very young children. In our series of 32 cases, only 2 patients were more than 5 years old, one

TABLE II.—REPORTED CASES OF INFLUENZAL MENINGITIS

Date	Authority	Cases	Recoveries
1911	Wollstein <sup>5</sup>	49	5
1910	Simon <sup>6</sup>	12	..
1916	Torrey <sup>7</sup>	30	5
1911 1917	Dunn <sup>8</sup>	15	..
1918	Koplik <sup>9</sup>	6	1*
1920	Stone <sup>10</sup>	14	1
1920	Meningitis Div.	32	1
	Total	158	13

\*Personal communication.

of these being 7 and one 18 years of age. Sixteen of our cases were in children one year old or less.

We were able to locate a probable primary focus in only 8 instances, and of these, 6 were cases of pneumonia, one clinical "influenza," and one a cold and cough. I am, however, unable to say whether or not these primary infections were due to the

influenza bacillus. It is certain that meningitis, due to the meningococcus, develops not frequently during or immediately following pneumonia. Lumbar puncture is all too often delayed because the physician feels he is dealing with a meningism or with

TABLE III.—INFLUENZAL MENINGITIS-SEASONAL DISTRIBUTION

	Jan. Feb. Mar.	Apr. May June	July Aug. Sept.	Oct. Nov. Dec.	Total
1912	..	2	..	..	2
1913	..	..	..	2	2
1914	..	..	1	1	2
1915	..	..	..	3	3
1916	1	2	..	3	6
1917	..	..	2	2	4
1918	1	1	1	1*	4
1919	..	..	..	8	8
1920	..	1	..	..	1

32

\*During epidemic of influenza in city.

a meningitis secondary to the pneumonia, probably due to the pneumococcus or streptococcus.

Table III gives the seasonal distribution of cases. It shows a tendency for the disease to develop in the fall and early winter.

But it is particularly interesting to note that in the fall of 1918, when the epidemic of influenza was raging in New York City, we saw only one case of meningitis due to the Pfeiffer bacillus.

This has seemed to me good evidence against the Pfeiffer bacillus being the causative factor of this epidemic. If the organism has been present in such vast numbers and with such heightened virulence as to have caused such an epidemic, it seems impossible that there would not have been an increase in the number of cases of influenzal meningitis. This has been commented upon in an earlier paper by me,<sup>12</sup> and Stone<sup>10</sup> also called attention to the same point in his experience in Texas.

As stated in a previous paragraph, there is nothing characteristic in the symptomatology of influenzal meningitis. Two cases even had a hemorrhagic rash, which is so often considered diagnostic of epidemic meningitis. The course of the disease varies greatly, from 2 to 3 days to a month or more. It is usually well over a week. Table IV shows, in tabular form, certain points of interest in the cases we have seen.

A study of the 13 cases in Table II, in which recovery took place, shows that the treatment was as follows: In 9 instances lumbar puncture alone was used; in one instance electrargol was given intravenously daily for a week; in 2 instances anti-influenzal serum was used; in one, vaccine was given intraspinally.

An anti-influenzal serum, prepared by Wollstein<sup>13</sup> in 1911, produced favorable results in experimental influenzal meningitis in monkeys. This was the serum used in 2 recoveries reported by Torrey. It has not had a fair trial clinically as the disease is too rare to furnish an adequate number of cases and the serum is often administered late. Dunn<sup>8</sup> reports that he has used it in 11 cases without a recovery, but that too few doses were given to furnish an adequate estimate of its value. We have used it in 5 cases, in 3 of these only 1 or 2 injections were given; in the other 2, the injections were repeated about 10 times in 1 instance and 15 times in the other. These last 2 patients showed temporary improvement clinically; the organisms decreased greatly in number and become largely intracellular, but death finally resulted. The serum should certainly be used when available.

A brief description of one case (No. 28 in our series) that recovered may be of interest.

TABLE IV.—AUTHOR'S SERIES OF CASES

No.	Age	Possible Primary Infection	Treatment*	Duration	Outcome
1	T. F. 2 mo.	Pneumonia	L. P.	4 days	Death
2	A. B. 2 mo.	None	L. P.	3 days	"
3	K. H. 4 mo.	None	L. P.	22 days	"
4	E. M. 4 mo.	Pneumonia	L. P. & V. P.	44 days	"
5	M. S. 5 mo.	None	L. P.	6 days	"
6	A. M. 5 mo.	None	L. P.	2 days	"
7	T. A. 5½ mo.	None	L. P.	6 days	"
8	F. L. G. 6 mo.	None	L. P.	13 days	"
9	M. I. 8 mo.	None	L. P.	9 days	"
10	L. T. 8 mo.	None	L. P.	12+days	"
11	P. P. 8 mo.	Pneu. & infl.	L. P.	22 days	"
12	L. K. 9 mo.	Pneu. & wh. cgh.	L. P. & 1 dose A. I. Ser.	6 days	"
13	J. S. 10 mo.	None	L. P.	12 days	"
14	J. C. 11 mo.	None	L. P.	4-5 days	"
15	A. C. 1 yr.	None	L. P.	5 days	"
16	P. D. A. 1 yr.	Pneumonia	L. P. & 1 dose A. I. Ser.	5 days	"
17	J. C. 1¼ yr.	None	L. P.	30 days	"

TABLE IV. (*Continued*)—AUTHOR'S SERIES OF CASES

No.	Age	Possible Primary Infection	Treatment*	Duration	Outcome
18	K. M. 1 $\frac{1}{3}$ yr.	None	L. P.	10 days	"
19	F. P. 1 $\frac{1}{2}$ yr.	None	L. P.	12 days	"
20	J. G. 1 $\frac{1}{2}$ yr.	None	L. P.	17 days	"
21	C. D. 1 $\frac{1}{2}$ yr.	None	L. P.	6 days	"
22	A. M. 1 $\frac{2}{3}$ yr.	None	L. P. & A. I. Serum (10 doses) Autog. Vaccine.	21 days	"
23	T. C. 2 yr.	None	L. P.	23 days	"
24	G. C. 2 yr.	Pneumonia	L. P.	33 days	"
25	M. C. 2 yr.	None	L. P. & A. I. Serum	8 days	"
26	G. L. 2 $\frac{1}{4}$ yr.	None	L. P.	19 days	"
27	J. K. 2 $\frac{1}{2}$ yr.	None	L. P.	60 days	"
28	P. M. A. 2 $\frac{1}{2}$ yr.	Cold & cgh. 4-6 weeks earlier	L. P. & Vac- cine — intra- spinally — A. I. Ser.	30 days	Recovery
29	C. V. 3 yr.	None	L. P.	30+ days	Death
30	A. H. 4 $\frac{3}{4}$ yr.	None	L. P. & 1 dose of A. I. Serum	6 days	"
31	E. K. 7 yr.	None	L. P. & A. I. Serum — 15 doses. Vaccine subcut.	28 days	"
32	R. L. 18 yr.	Clinical "influenza"	L. P.	7 days	"

\*A. I. Serum=Anti-influenzal serum.

L. P.=Lumbar puncture.

V. P.=Ventricular puncture.

Phyllis McA., 2½ years of age, had been well, except for a mild cold and cough 4 to 6 weeks earlier. She had not recently been in contact, so far as we know, with any sick person. She was taken ill, suddenly, August 21, 1920, with headache, vomiting and fever, ranging from 99° to 102°. Two lumbar punctures were done, August 22 and 26. The spinal fluids were sent to us for examination and the second one showed the Pfeiffer bacillus. On August 28, the child was seen by Dr. Jackson of the Meningitis Division. Twenty-five cubic centimeters of turbid fluid were withdrawn and 500 million of a stock influenza vaccine were injected intraspinally. The child's mother objected to lumbar punctures, especially in view of the fact that we could hold out little hope for recovery, and it was not possible to persuade her to permit regular treatment.

On August 31, another puncture was done, 1000 million of vaccine being given mixed with antimeningitis serum as the smear from the previous fluid had showed coccoid forms, which suggested that the meningococcus might also be present.

Further study showed that this fluid as well as the previous ones contained the Pfeiffer bacillus in pure culture. At this point the case showed some improvement, and no further treatment was permitted until September 9, when the child became suddenly worse with a rise of temperature and vomiting. A puncture was done and influenza vaccine was again administered. This was repeated about every other day, the case showing considerable improvement. An autogenous vaccine was used as soon as it could be prepared. On September 18, the fluid for the first time gave a negative culture, the previous 8 fluids having been positive. At this puncture, anti-influenzal serum (prepared by the Research Laboratory, but not available until this time) was given in addition to the vaccine. (Therefore in this particular case at least the serum cannot be credited with the disappearance of the organism and the ultimate recovery of the case.)

The administration of combined serum and vaccine was repeated on the 20th and 22nd of September. On September 24 and October 2, lumbar puncture was done for the relief of pressure, no injection being made. The child showed steady improvement in the general condition. Deafness, which had developed early in the illness, and had seemed to clear up, returned about the middle of September. It did not seem to be complete

and was apparently showing a little improvement when the child went to the country around the middle of October. Her general condition at that time was excellent.

In several cases of meningitis not due to the meningococcus, I have used a vaccine intraspinally with the hope that its gradual absorption into the blood stream would bring about whatever beneficial effects result from vaccine given intravenously without the degree of shock usually following that method of administration. I have had the opportunity of using several injections in this way in 2 cases each of streptococcic and staphylococcic meningitis, with recovery in 1 case of staphylococcic meningitis and temporary improvement in the 3 other cases. The reaction following this treatment has never been very severe, and I have seen no harmful results, though in some cases I have worked up to as large a dose as 5 billion, diluted in about 10 c.c. of normal saline. The vaccines used were either stock vaccines of the same variety as the organisms present or autogenous vaccines when such could be prepared, as it was desired to get any specific effects that might be obtained in addition to the general protein reaction. Sampietro<sup>14</sup> and others have recently recommended homologous vaccine in protein-shock treatment as it seems to give better results and to be less toxic.

The intravenous administration of vaccine has been used also in treating meningitis. Typhoid vaccine was used in this way in a case of epidemic meningitis on the Fourth Medical Division at Bellevue Hospital. This patient had developed a walling off of the spinal fluid, repeated lumbar puncture resulting in dry taps. The condition was getting worse and indeed seemed to be quite desperate. The intravenous administration of the vaccine was followed by considerable shock. The man improved temporarily but died about 4 months later.

A case of blocked epidemic meningitis in a baby with intraventricular administration of serum, followed by vaccine intravenously with recovery, has recently been reported by de Angelis.<sup>15</sup>

Recoveries from purulent meningitis, due to organisms other than the meningococcus, are few. Most of these have occurred after lumbar puncture alone. In view of this fact, I wish to make it clear that I do not assert that intraspinal vaccine treatment cured the case of staphylococcus and of influenzal meningitis respectively that I have described nor that the intravenous admin-

istration of vaccine cured the case of blocked epidemic meningitis to which I referred. However, recovery did follow the use of vaccine in these cases.

In the absence of methods promising better results, it seems worth while, in addition to the use of a homologous serum, where such is available, to try the intraspinal or intravenous administration of vaccine in suitable cases. This course would be indicated under the following conditions; in cases of meningitis not due to the meningococcus, in blocked forms of epidemic meningitis and in other cases of epidemic meningitis, which do not yield readily to serum treatment.

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#### INTESTINAL OBSTRUCTION (Journal A. M. A., Dec. 20, 1919).

A case of fatal intra-uterine intestinal obstruction from inspissated and impacted meconium in an infant causing death, is reported by J. G. M. Bullova and R. E. Brennan. They have found no record of any previous case of this kind. The preoperative diagnoses were intestinal obstruction from volvulus or maldevelopment, such as lack of fusion of the sigmoid and rectum. The presence of rhythmic movements which caused a dimple to appear in the proctoscope, and evacuation of a very slight amount of sebaceous material served to indicate a muscular continuity of the intestine. The case is interesting as giving the absolute size of the colon in the new-born as well as the origin of at least part of the meconium.—*Journal A. M. A.*



# SPLenic ANEMIA OF INFANCY WITH REPORT OF A CASE OCCURRING IN AN INFANT AT SIX WEEKS OF AGE.

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The disease occurring in infants, usually in the first 2 years of life, characterized by great pallor, enlargement of the spleen and liver, low red blood cell count, low hemoglobin and the presence of narrow cells is commonly known as anemia pseudo-leukemia infantum of von Jaksch. The term "anemia infantum pseudoleukemia" was originally adopted on the ground that the disease was related to Hodgkin's disease.

The clinical picture was first described by Gretscl in 1866. Cohnheim described the pathology in the preceding year. Somma in 1884 described the same condition under the title of "anemia splenica infantile." In 1889 von Jaksch presented a case of "leukemia" in a child of 14 months and in 1890 he reported 3 cases of enlarged spleen in children under the name "anemia pseudo-leukaemia infantum." Since then many cases of splenic anemia have been reported in the literature. These have been ably reviewed by Wentworth and Stillman.

The modern consensus of opinion is that "anemia pseudo-leukemia infantum" bears no clinical or pathological relation to leukemia. Such authorities as Wentworth, Hutchinson and Giffin agree that this terminology should be discarded and the disease referred to as splenic anemia of infancy.

Hunter classifies the splenic anemias of infancy and childhood into the following types:

*Type I.* Large spleen, gradually developing or recurring anemia. Blood picture of secondary anemia with relatively low color index and absence of leucocytosis. Lymphocytes in normal percentage (40-50%). Only occasional normoblast.

*Type II.* Leucocyte count 10,000 to 20,000, with variable number normoblasts and megaloblasts. Color index relatively higher.

*Type III.* Leucocyte count above 20,000. Greatest number of normoblasts together with occasional megaloblasts, eosinophiles and myelocytes.

Giffin groups the cases into 2 classes: "First, those conforming to the syndrome of the splenic anemia of adults, with absence of leucocytosis; and second, those conforming to that of the splenic anemia of infancy and showing a leucocytosis, the presence of a variable number of marrow cells and a relatively high color index."

The case I wish to report falls into the second group with the exception that all blood counts but one showed an absence of a leucocytosis.

H. P., age 18 weeks, was first seen at The Clinic on March 3, 1920. First child of healthy parents age 32 and 27. He was a full term well formed and developed baby weighing 6½ pounds at birth. Family history negative for tuberculosis and lues. He had been apparently a normal, active, good natured infant with good color until at 6 weeks of age the parents noticed the rapid onset of a marked anemia which gradually progressed. The child became very restless, slept very little and seemed hungry, probably because of the decreased supply of the mother's milk following her mental anxiety upon the realization that her offspring was the victim of a serious disease. Physicians who were consulted gave a grave prognosis and prescribed iron and arsenic preparations, which were given by mouth, further disturbing the patient's digestive apparatus. Physical examination showed an extreme degree of pallor of the skin and mucous membranes. The patient when asleep resembled a marble figure more than an animate being. He was, however, well developed, active and bright. The skin showed some evidence of weight loss, but tissue turgor was quite good. There was no icterus. No general adenopathy. Hair very abundant. Head well shaped. Examination of the heart showed enlargement with a loud blowing systolic murmur at the mitral area, not well transmitted. Liver dullness extended to the umbilicus. The liver was quite firm and easily palpated. The spleen filled almost the entire left abdomen. The hard firm edge was easily palpated. Physical examination was otherwise normal.

Laboratory findings were as follows:

Erythrocytes, 1,742,000 (35%)

Hemoglobin, 30%

Leucocytes, 8,735

Color Index, 0.86

Differential:

Date	Weight lbs.	Hemo- globin	R. B. C.	W. B. C.	Normoblasts per 100 W. B. C.	Mega- blasts	Myelocytes	Anisocytosis	Polychromasia	DIFFERENTIAL.						Remarks:
										S. M.	L. M.	T. R.	P. M. N.	P. M. E.	P. M. B.	
3-3-20	8-8.	30.	1,742,000.	8,735.	26.	2.	1.	++	++	35.	40.	0.	25.	0.	0.	Wassermann—0. Von Pirquet—0. Whole blood buttocks—50 cc. Fragility 0.5-0.4. GROUP II. Transfusion.
3-12-20	8-8.															
3-19-20	8-8.	40.	1,672,000.	9,100.	7.	1.	2.	+++	+++	65.	9.	1.	21.	0.	2.	Transfusion.
3-26-20	8-8.	47.	2,592,000.	15,640.	1.	0.	1.	+++	+++	70.	4.	1.	20.	2.	0.	Complementary feedings. Transfusion.
4-2-20	8-8.															Transfusion.
4-9-20	9-4.	60.	2,608,000.	6,080.	11.	0.	1.	++	++	65.	14.	2.	17.	1.	1.	Transfusion.
4-13-20	9-5.															
4-17-20	9-10½.															
4-21-20	9-15.															
4-24-20	10-1½.	60.	3,304,000.	9,720.	0.	0.	0.	+	+	73.	11.	3.	12.	0.	1.	
5-1-20	10-6½.	65.	3,600,000.	7,360.	0.	0.	0.	+	+	79.	13.	1.	7.	0.	0.	
5-5-20	10-12½.															
5-14-20	11-4½.	70.	3,844,000.	5,740.	0.	0.	0.	—	—	70.	5.	3.	20.	2.	0.	
6-19-20	13-8.	80.	4,392,000.	4,975.	0.	0.	0.	—	—	83.	0.	0.	17.	0.	0.	

Small mononuclears, 35%

Large mononuclears, 40%

Polymorphonuclears, 25%

Transitionals, 0

Eosinophiles, 0.

Mast, 0

Myelocyte, 1

Normoblasts, 26 per 100 leucocytes

Megaloblasts, 2 per 100 leucocytes

Marked anisocytosis and poikilocytosis and polychromatophilia.

Polychromatic rings, ring forms and other degenerations. Nucleated reds, often in mitosis. Several cells difficult to classify accurately.

*Fragility Test.*—Hemolysis began at 0.5 per cent. and was complete at 0.4 per cent.

*Grouping.*—Parasthenic (II) ischemagglutin group. The child's father, but not his mother, belonged to the same group.

Wassermann reaction of patient, mother and father, negative.

Von Pirquet—Negative.

Urine—Normal except for very slight trace of albumen.

Stool—Normal.

On March 5, while completing the hematological studies, 50 c.c. whole blood from the mother was given into the patient's buttocks. Beginning March 12, 1920, a transfusion of 40 to 50 c.c. citrated blood from the father was given into the jugular veins every seventh day. The improvement in hemoglobin and red blood cells is shown in accompanying table. Beginning March 30, the green citrate of iron in gr.  $\frac{3}{8}$  doses was given intramuscularly twice a week. Owing to the fact that the baby obtained only about an ounce of milk from the mother's breast at each feeding, complementary feedings were instituted on March 26. On April 9, he showed a gain in weight for the first time, a total gain of 12 ounces from March 26 to April 9. There was also a very marked improvement in color of the mucous membranes and skin, tissue turgor was good, the child was bright and active, slept well and cried very little.

Improvements continued until, on June 18, 1920, the child weighed 13 pounds 8 ounces, had a hemoglobin of 80 per cent. and 4,392,000 red cells. Normoblasts were not present. Relative

lymphocytosis of 83 per cent. persisted. The spleen was not palpable. The heart murmur had disappeared.

A review of the literature fails to reveal a similar case occurring in an infant as early as 1½ months.

Many authors, notably Carpenter and Ashby, insist on a relationship between rickets and splenic anemias of this type. The age of the child, the fact that it was breast fed and its physical examination rule out any bearing of rickets as an etiological agent or concomitant derangement. The evidence of this case bears out the contention of Carr: "That in certain cases of the splenic anemia of infancy there is no evidence whatever of rickets."

The lack of any skin manifestations, adenopathy, etc., together with a negative Wassermann in the patient, mother and father rules out lues as a casual factor in the disease.

In considering cases of this type, it is well to remember that the blood of children and particularly the blood of infants under 2 years differs normally from the blood of adults. A moderate leucocytosis, which is essentially a lymphocytosis, is quite constant and marrow cells are occasionally observed. A lymphocyte percentage of 40 to 50 per cent. in infants under 2 years is normally observed. This fact is always to be taken into account in considering any case of infantile anemia. The blood of infants reacts differently than adults to toxic agents.

"In fetal life the spleen and the liver are generally believed to be responsible for the formation of the red blood cells. In extrauterine life this function is taken over by the red bone marrow. In the primitive condition all red blood cells are supposed to be nucleated. In extrauterine life the nuclei of the red cells are lost, and nonnucleated forms are alone present in the blood stream. In fetal life and in a certain pathological condition, the rate of blood formation is so rapid that some nucleated cells appear in the blood. The normal response of the body to a loss of red blood corpuscles consists in an increased activity of the blood-forming cells of the red bone marrow.

"The diminished rate of blood cell formation sometimes noted after blood transfusions may be explained by assuming that the stimulus which awakens the formation of red cells in the bone marrow is absent or made subnormal on the injection of red cells into the blood, and thus the formation of red cells is depressed.

Small transfusions are, therefore, preferable to large ones in cases in which the rate of blood formation is greatly impaired.

"The nature of the stimulus which brings about the new formation of red cells is not understood. Oxygen want may be an important factor, since we find the presence of an abnormally large number of red cells in conditions where there is a scarcity of oxygen in the inspired air, as in life at high altitudes, or a difficulty in its absorption through the lungs, as in congenital heart disease."—Macleod.

Giffin collected 5 cases of splenectomy and the Mayo Clinic adds one. Youngest case reported is in a child of 9 months by Pool of New York.

#### SUMMARY

1. A case of splenic anemia, resembling the so-called von Jaksch's anemia, occurring in an infant at 6 weeks of age is reported. This is younger than any case reported in the literature.

2. Rickets and lues and tuberculosis are ruled out as etiological factors.

3. Marked improvement with an increase in hemoglobin and red blood cells approaching normal, with disappearance of marrow cells from the blood stream and a gain in weight, followed repeated transfusions of small amounts of citrated blood and intramuscular administration of iron together with complementary feedings.

I wish to express appreciation to Dr. M. W. Lyon, Jr., for making the numerous blood examinations.

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DIPHTHERIA (*Journal A. M. A.*, Jan. 10, 1920). The importance of swabbing the throats of school children at the first appearance of diphtheria among them is emphasized by L. B. Gloyne. They may become carriers whose quarantine is as essential as that of the diphtheria patients themselves. Two negative cultures should be required as a minimum in every case in which a positive culture was obtained. Antitoxin has a definite place in immunizing against diphtheria, but it does not kill the bacillus. Carriers usually clear up entirely without the aid of antitoxin. Gloyne gives his experience with a school in a limited section isolated by natural boundaries in Kansas City, Kan., where fourteen cases occurred with the rest of the city free from the disease.—*Journal A. M. A.*

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ETIOLOGY OF INFLUENZA (*Policlinico*, Rome, March 9, 1919, p. 289). M. Segale's later experimental research apparently confirms the etiologic importance of the streptococcus which he has cultivated from influenza cases and which reproduces a similar set of symptoms when guinea-pigs are inoculated with it on the nasal mucosa. He is convinced that this streptococcus pandemicus is something new; others have cultivated the same germ in the present pandemic. The animals died when inoculated even with cultures that had been passed through a Chamberland filter. Hemorrhagic effusions were found in the peritoneum and lungs, with marked congestion of the respiratory apparatus. The same findings were observed in guinea-pigs treated with the filtrate that had been heated to 55° C. for an hour.—*Journal A. M. A.*

## EMPYEMA IN CHILDREN.\*

By EDWARD B. HODGE, M.D.,

Philadelphia.

As a surgeon, addressing such a gathering of physicians skilled in diseases of children, I feel a hesitancy about saying anything beyond the purely surgical confines of the subject. It will, however, help us considerably in this very sphere if we briefly review a few facts in connection with empyema, drawing freely from standard authors such as Griffith and Holt. Some interesting and helpful developments have also transpired of late as a result of experimental study and the surgery of the chest as seen in war wounds and the large series of empyemata during the influenza epidemic of 1918.

Experimental surgery has shown that in animal work the mediastinal tissues offer little support against changes of pressure in the normal chest. In the absence of adhesions, the effects of positive intrapleural pressure on one side are almost as marked on the other. To a certain degree this is true in the human subject, particularly so in the child whose mediastinal tissues are proportionately delicate. This has always been one of the drawbacks to intrathoracic surgery and has been met in recent years by the introduction of the various forms of negative and positive pressure apparatus.

During the war, a great deal of chest surgery was done, most of it without such apparatus and much of it with surprisingly little trouble from these pressure phenomena. Various explanations have been offered to account for these seemingly contradictory facts. It must be admitted that as yet there is not complete harmony between theory and practical experience. Continued experimental efforts, linked up with closer observations and keener analysis in our clinical work, are needed to solve the problem.

Certain it is that the presence or absence of adhesions has a most important bearing on empyema both in diagnosis and in treatment. The bacteriology of the condition as a guide to prognosis and treatment has assumed a much clearer and more valuable position by the results of study of large numbers of cases of empyema in the training camps during the influenza epidemic

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\*Read before the Philadelphia Pediatric Society, April 13, 1920.



A large proportion of these were due to the hemolytic streptococcus. Our former experience has been very definitely confirmed. The pneumococcus type is the most favorable and the streptococcus the least. Fluid should be examined in the smear as well as in the culture. Mixed infection is often present and not infrequently one type of microorganism has died out and can only be detected by the smear.

There is probably pleurisy over every large consolidated area in bronchopneumonia. Small effusions are common; large, rare. We find empyema in both broncho and lobar pneumonia but more frequently in the latter. Nine-tenths of empyemata in children occur with or after pneumonia or pleuropneumonia, leaving one-tenth the result of acute infectious diseases, pyemia and suppurative foci elsewhere than in the lungs. Recently Moschowitz, in an address in this city (Mütter Lecture), advanced the theory that most, if not all, empyemata are the result of direct rupture of an abscess of the lung into the pleural cavity. Careful search in necropsies on children with empyema should be made to check up this view. Under 2 years, the pneumococcus and the male sex predominate. The left side is involved in three-fifths of the cases. The lesion is double in 3 per cent., but more often in infants. The younger the child, the more frequently is empyema a complication.

Localized or sacculated empyema is common but inter-lobar rare. The fluid in the streptococcus type is thinner and adhesions rare. In pneumococcus form adhesions are common, pleura thickened and masses of fibrin frequent. The lung does not float, but if adhesions do not prevent, is surrounded on all sides and compressed. As a result of this compression, there is seen following empyema 3 types of recovery: 1. Practically complete; 2. Partial expansion and recession of chest wall from very firm adhesions; 3. Same, plus low grade interstitial pneumonia.

Empyema is a very serious complication in children. If any operator doubts this, he should tabulate his cases. If this mortality rate has been below 30 per cent. he has been most fortunate. Holt quotes a series at the Babies Hospital, showing for the first year of life, 74 per cent., second, 59 per cent., third, 13 per cent. However, our figures are due to improve as a result of better selection in type of operation and improved after-treatment. It must always be borne in mind that the mortality varies with the type

of infection, with different epidemics and at different stages of the same epidemic.

The symptoms of empyema in children are familiar enough. There is pallor, anemia and prostration during or after pneumonia. Respiration is accelerated, 40-70, and cough is usually present. Dyspnea is sometimes marked but may be strangely slight. The temperature is variable, often high, not seldom low, and rarely of hectic type.

In diagnosis it may safely be said that the most reliable signs are flatness, feeble breathing and heart displacement. Auscultation is notoriously deceitful in children. Absence of tactile fremitus is often of value. The aspirating needle is the court of last appeal. In cases of sacculated or inter-lobar type, where lung comes between the empyema and chest wall, the needle may fail for a time. So, too, where the collection is thin and diffuse, the needle may be inserted too deeply, enter lung tissue and give a negative and misleading result. Under 3 years, fluid is likely to be pus; from 3 to 7, pus more often than serum (Holt). X-ray is most helpful in demonstrating the location and extent of the fluid. It does not supplant the exploring needle.

Unresolved pneumonia is the main bugbear in differential diagnosis. Here dullness is over one lobe usually, râles or friction sounds may be heard and there is never cardiac displacement. The needle is the final test again. Beware diagnosing unresolved pneumonia until after careful and repeated aspiration. In my experience it bears a relation to empyema similar to that of "rheumatism" to acute osteomyelitis.

In hospital work the surgeon seldom is called on for the diagnosis. Cases developing in the wards are almost never overlooked by the medical chief and those from the outside are usually detected by the resident on admission.

The possibility of chronic empyema should be kept in mind in conditions of long continued illness and wasting. Cases are on record where the condition has existed for months, even years, in all likelihood.

*Treatment.* In discussing the treatment of empyema, we need not go into the minutiae of operative technique and after treatment. That is of interest only to the surgeon. It will be helpful, I think, to sketch in outline the changes that have come about recently and the chief reasons therefore.

There is little doubt that in the past most of us have erred at times in doing too severe an operation on these children, particularly the younger ones, and often in operating too early. In the streptococcus type, with thin fluid and few or no adhesions, early rib resection or intercostal incision has made too sudden and severe a change in intrathoracic pressure. The aim should be to limit the size of the open pneumothorax. This is especially true where the patients are still ill with pneumonia. In such cases, aspiration relieves pressure and dyspnea and tides the patient over until adhesions have formed and the general condition improved. Then formal operation becomes far less dangerous. The aspiration may be repeated several times at intervals of a day or more.

Aspiration as a curative measure has not been successful and is no longer used. To prepare for a safer subsequent operation, it is a very valuable procedure. It can and should be done by the physician in attendance or in consultation with the surgeon. Aspiration with injection of formalin-glycerin solution was advocated by the late John B. Murphy. While it has cured some small collections, usually of pneumococcic origin, it is too uncertain to be recommended.

Intercostal incision is the operation most generally applicable in children, often preceded, as stated above, by aspiration for temporary relief. Formerly rib resection was preferred because the narrow intercostal space in children did not permit finger exploration of the cavity and drainage tubes were in danger of being blocked by rib pressure. Too large or stiff a tube also can cause rib necrosis. The change in opinion has come about largely as a result of the great advance of the war period—the Carrel-Dakin method.

Where formerly an acute empyema was never irrigated, now flushing with the sodium hypochlorite solution is generally used. It is well first to test for a lung communication with salt solution before starting the hypochlorite. Like all other good things the Carrel-Dakin method can be abused and should be used with brains. Fundamental surgical principles must still be observed. Most failures are due to such mistakes. The essential requisites for healing are sterilization of the cavity and lung expansion to obliterate the pneumothorax and restore negative pressure. To the former of these the Carrel-Dakin method is a valuable aid.

A good sized drainage tube for outflow, several small tubes for inflow and the two hourly introduction of a quantity of solution somewhat less than the measured capacity of the cavity—these are the chief essentials.

A useful sequence is to use tube drainage in an intercostal incision for a few days. If the age and condition of the child permit, it is an advantage to make this of the siphon type, thus limiting the pneumothorax and saving dressings and disturbance. Then the tube is supplemented by the Carrel-Dakin irrigation. The sodium hypochlorite solution has a marked solvent action on the masses of fibrin found in the pneumococcal cases. Its most enthusiastic advocates assert that it dissolves adhesions even when more or less organized, thus aiding lung expansion.

Rib resection is reserved chiefly for cases in which intercostal incision has been inadequate and for old cases with sinus or rib necrosis. It has often to be combined with freeing adhesions, sometimes amounting to partial decortication of the lung. The after-treatment is conducted along lines identical with that of the simpler operation.

Both intercostal incision and rib resection can be done very readily with local anesthesia infiltration. In the presence of marked fright or when adhesions must be broken up, general anesthesia is necessary, preferably gas-oxygen. The prone position, introduced by Elsberg, has been helpful in my experience.

Along with these operative measures, exercises to expand the lung should be stressed as early as possible. Too frequently this is neglected by surgeons. Whether in the form of toys, balloons, soap bubbles, masks, water bottles, or by crying, it is of great value and often turns the tide in favor of expansion and healing.

By this scheme of graduated operative treatment, more lives will be saved and mutilating operations for collapse of the chest wall will be almost entirely avoided. The Schede and Estlander operations are seldom necessary in children and we may now hope for their complete disappearance. With their attendant ills of deformity, contracted chests and lateral curvature, they can well be spared.

A point often not sufficiently realized is the great drain on the child's metabolism through the profuse discharge in empyema. This should be met by prompt raising of the food intake. The ways and means of introducing the necessary calories are more

familiar to you than to me. To this factor, as well as to inability properly to expand the lung, may be attributed the observation that babies often do well for a week after operation and then fail. Most surgical troubles after operation are due to poor drainage and imperfect sterilization of the cavity. Lung abscess, pneumonia in another lobe or opposite lung, pericarditis and other complications do occur. But the burden of proof is on the surgeon to show that the source of trouble is not in the drainage tract.

In conclusion, may I emphasize the following points:

1. Frequency and danger of empyema in children.
2. Value of aspiration, not alone in diagnosis, but in treatment preparatory to operation.
3. Consequent increase of interest to the physician in the treatment and greater need than ever for coöperation between him and the surgeon.
4. Greater chance for patient by reason of an operation better considered as to time, type, and condition of patient and an improved after-treatment.

*346 South 16th Street.*

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POSTDIPHTHERIC PARALYSIS (Revista di Clinica Pediatrica, Dec. 1919). Spolverini queries whether the postdiphtheric flaccid condition of the muscles should properly be called paralysis, as the disturbances are more in the nature of myasthenia in the majority of cases and in four he describes here and compares with similar cases on record. In three of his cases the disturbances were arrested with antitoxin, and they retrogressed completely in from twenty to forty days. The larger the amount of antitoxin injected, the prompter the cure. In the fourth case the antitoxin had not been commenced until the twenty-seventh day, and only comparatively slight improvement was realized. These cases teach further the necessity for taking smears from the nose with postdiphtheric paralysis, as this may reveal virulent diphtheria bacilli. Some even assert that nasal diphtheria is more apt than other forms to be followed with paralysis.—*Journal A. M. A.*

## STUDIES IN CRANIOTABES.

By ABRAHAM LEVINSON, M.D.

Chicago.

This paper presents the results of a study of craniotabes made at an Infant Welfare station where 99 per cent. of the children were of the colored race. Altogether, 760 infants were observed. Each child was seen on an average of twice a month, making the number of inspections 8,820. The ages of the children studied varied from 1 week to 2 years.

The problems studied were as follows:

1. The percentage of the children at the station that showed craniotabes.
2. The frequency of craniotabes in breast fed, as compared to that in artificially fed infants.
3. The age at which craniotabes started, and at which it disappeared.
4. The location of craniotabes in relation to the different bones of the skull.
5. The relation of craniotabes to rosary and epiphyseal enlargement.
6. The effect of orange juice or cod liver oil on craniotabes.

The method used in the examination of the child for craniotabes is the following: The head of the baby facing the examiner, is grasped between both hands on different parts of the skull. If craniotabes is present, portions of the bones of the skull give way under the fingers. I have learned that the softenings of the skull are of 2 kinds, (a) when the depressable portion of the bone presents a crackling sensation resembling parchment or eggshell, (b) when the bone presents a soft mushy feeling. As a rule the craniotabes of the soft mushy type is more extensive than the crackling type, but in all other points they differ in no way from each other.

I marked the degree of craniotabes according to the extent of bone involved, 1 plus signifying a moderate involvement, 2 plus a more marked involvement, and 3 plus a very marked involvement.

The source of error in a study of craniotabes is the fact that near a suture the bone at times caves in under slight pressure.

I have, however, taken care to differentiate between a caving in of the whole bone near the suture and the caving in of a part of the bone, which is true craniotabes.

*Frequency of Craniotabes.* Different observers give different figures as to the frequency of craniotabes in children. In 100 children observed by Kassowitz in a Vienna ambulatorium, 47 showed doubtless craniotabes. Of these 100 children, 84 were syphilitic and 16 were free from syphilis or showed only doubtful symptoms. In another investigation of 100 children by Kassowitz, there were 45 who showed craniotabes. Of these 100 children, 81 showed rickets and 19 showed no rickets or very doubtful signs of it. Forty-five of those that had rickets had craniotabes and 36 of those who had rickets had no craniotabes. Three showed signs of hereditary syphilis and also showed craniotabes and other rickety manifestations. Moore found 130 cases of craniotabes in a series of 942 children examined by him.

Of the 760 cases studied by me, 162 showed craniotabes, which makes approximately 21 per cent. The sexes were divided as follows: 91 boys and 71 girls, a slight preponderance in favor of boys.

*Feeding.* In my series of 162 children that showed craniotabes, there was a preponderance of it in breast fed children. If we take, for the sake of comparison, the first date on which craniotabes was noticed, we find the following figures:

Breast feeding .....	124
Mixed feeding .....	15
Artificial feeding .....	23

If we take all the different examinations of these 162 cases we get the following:

Breast feeding .....	342
Mixed feeding .....	42
Artificial feeding .....	31

This striking difference, however, is accounted for somewhat by the variation in age.

*Age.* Elsasser's earliest case of craniotabes was observed at 3½ months of age. Zappert says that craniotabes nearly always appears during the first half, rarely during the first quarter, of the first year, and sometimes continues after the second year.

I had occasion to watch the appearance of craniotabes, the

intensification of it, and its disappearance in one and the same case.

I found the greatest number to appear between the first and third month, to be intensified during the fourth and fifth month,

TABLE SHOWING RELATION OF CRANIOTABES TO TYPE OF FEEDING AND AGE INCIDENCE.

	Breast fed	Mixed	Artificial
Less than 1 month	1		
1/2 months	30		1
2/3 months	62	3	3
3/4 months	81	1	
4/5 months	76	2	5
5/6 months	58		7
6/7 months	17	11	4
7/8 months	9	10	7
8/9 months	6	11	2
9/10 months	1	4	
10/11 months			1
11/12 months			
12/13 months			1
13/14 months			
14/15 months			
15/16 months			
16/17 months			
17/18 months	1		

to get less intense or smaller in area during the sixth and seventh month, and to disappear during the eighth and ninth month. I have only seen 1 case of craniotabes between the twelfth and



thirteenth month, and 1 case between the sixteenth and seventeenth month.

Case G.V., for instance, showed no craniotabes at 6 weeks of age, had marked craniotabes at 2 months, at 3 months, at  $3\frac{1}{2}$ , at 4 months, at 5 months, at  $5\frac{1}{2}$ , at 6, and at 7 months. At 8 months the craniotabes was very slight, and at  $8\frac{1}{2}$  months it had disappeared.

Case J.C.R. showed no craniotabes at 4 months, marked craniotabes at 5 months but none at 6. Case J.W. showed no craniotabes at 1 month, moderate craniotabes at 3 months, marked at 5 and  $5\frac{1}{2}$  months, but disappeared at  $7\frac{1}{2}$  months. Case F.M. showed no craniotabes at 3 weeks, moderate craniotabes at  $1\frac{1}{2}$  months, marked at  $2\frac{1}{2}$ , still more marked at 3, and stayed so until 6 months when the craniotabes became moderate again and disappeared at 7 months.

There were many cases that illustrated the point. In fact, nearly all of them showed the same course.

In this connection, it is interesting to note the work of Hess and Unger. These authors examined infants once in 3 months, and in some cases they found craniotabes present at 5 months of age, which disappeared at 8 months of age. Since these authors gave their patients cod liver oil, they argued that the oil is a prophylactic measure against rickets. My records, however, show plainly that all craniotabes disappear at the age of 7 or 8 months, so that while I do not deny the value of cod liver oil in rickets, I cannot be convinced that it was the cod liver oil that was responsible for the disappearance of craniotabes in children older than 6 months in the cases observed by the above authors.

It is also interesting to note the work of Cohn, quoted by Zappert, done among the poor population of Berlin. Of 100 children in the first 3 months of life, 53.8 per cent. were affected with craniotabes, in the second 3 months 43.4 per cent., and in the last 2 quarters of the first year 38.35 per cent. were affected.

It is also interesting to note the work of Chaunier. In 37 children, he observed craniotabes 45 times; 2 times at 1 month; 8 times at 2 months; 8 times at 3 months; 8 times at 4; 5 times at 5; 4 times at 6; 4 times at 7; 1 time at 8; 2 times at 10; 1 time at 11; and 1 time at 15 months.

*Location.* Elsasser found most craniotabes over the occiput and some over the parietal bones. Holt speaks of craniotabes as

a "deficiency in calcium over areas in the occipital bone." Kassowitz speaks of occipital and parietal craniotabes. Still states that "craniotabes is confined to the occipital bone." Jacobi speaks of occipital and parietal craniotabes. My results are as follows: 324 times the craniotabes were found over the parietal bones, 80 cases over the temporal, and only 19 over the occipital. Of the 324 parietal cases, 77 were confined to the right parietal, 53 to the left parietal, and 194 cases showed craniotabes on both parietal bones. The extent of the craniotabes varied from the size of a nickel to the whole parietal bone, but the greatest majority of cases showed craniotabes at the posterior third of the parietal.

Of the 80 cases which showed craniotabes over the temporal, 9 had their location over the right temporal, 3 over the left temporal and 68 over both temporals.

To make certain that I have not mistaken the location of the craniotabes, I always felt for the parieto-occipital suture, and felt for craniotabes below the suture and above it. I have attempted to show the location of the craniotabes by x-ray, but was not very successful. One case from the Sarah Morris Hospital, which showed craniotabes at the parietal region upon entrance, came to a postmortem and gave me a chance to observe the different bones of the skull. This child, who was 4 months of age and breast fed, died of peritonitis. The posterior fontanelle and all the sutures were closed. The anterior fontanelle was partly ossified. On removing the skull, the posterior third of both parietals gave way under pressure, and when held up to the light the crackling portion of the parietal was transparent like paper. Only here and there were scattered a few dark areas with lime deposit.

*Nature of Craniotabes.* As is well known, the nature of craniotabes has been the subject of controversy for many years. Lees and Barlow considered craniotabes a symptom of hereditary syphilis. Kassowitz considered craniotabes a manifestation of either rickets or syphilis, but according to him, syphilis is one of the many causes of rickets. Wagner has tried to prove anatomically and microscopically the intimate correlation of rickets, syphilis, scrofula and tuberculosis. Jacobi considers craniotabes a manifestation of rickets and also sees a relation between rickets, syphilis and tuberculosis. The study of the relation of craniotabes to rosary and epiphyseal enlargement, commonly considered signs

of rickets, is therefore quite interesting. Moore saw in a series of 942 cases about 362 cases with craniotabes, 265 showed rosary, 73 Harrison's Groove, and 102 large epiphyses. The number possessing 2 signs were 127, and the number possessing 3 signs were 43.

In my series of cases, rosary usually made its appearance at  $4\frac{1}{2}$  to 6 months of age, rarely (4 cases) at 3 months. Epiphyseal enlargement usually made its appearance at 5 months, either simultaneously with rosary or somewhat later, occasionally at the sixth month. Often the rosary appeared just at the time the craniotabes disappeared. This, however, does not speak against the rachitic nature of craniotabes, for as is seen age plays a great role in craniotabes, and while the symptoms were not present at the same time, they followed each other.

There were only 5 cases with marked craniotabes which were not followed by other rachitic manifestations. These cases seem so interesting that we will give fuller data of them.

Case 1 developed craniotabes at 6 months of age and was getting more marked. When 5 months of age, the baby was given orange juice and at 6 months cod liver oil. When seen at 7 months (1 month's cod liver oil, feeding then being mixed) the baby had no craniotabes, no rosary and no epiphyseal enlargement.

Case 2 developed craniotabes at 2 months, getting more intense right along. At 4 months, orange juice was started, but with no effect, craniotabes still being present at 7 months. Then cod liver oil was started, and at 9 months not only did the craniotabes disappear as was expected, but there was no rosary nor epiphyseal enlargement.

Case 3 developed craniotabes at 2 months (on breast feeding) and was getting more intense. At 4 months, orange juice was started and at 5 months cod liver oil. At 7 months (mixed feeding and oil) there was no craniotabes, no epiphyseal enlargement and no rosary. The same was true at  $8\frac{1}{2}$  months.

Case 4 had craniotabes at 8 months of age, when it was getting breast milk and Imperial Granum. The craniotabes continued till  $9\frac{1}{2}$  months of age, when it was weaned and cod liver oil given. When observed at  $16\frac{1}{2}$  months, it had not developed rosary nor epiphyseal enlargement.

Case 5 was an artificially fed child that came to the Infant

Welfare Station with marked craniotabes (child was ninth to its mother). It was not put on cod liver oil until it was 10 months old, but it never developed rosary nor epiphyseal enlargement.

I was unable to make Wassermann tests on all our cases, but clinically, I found only 2 cases that presented luetic symptoms. I, therefore, have no grounds for associating craniotabes with lues.

No definite conclusions can therefore be drawn from this study as to the nature of craniotabes. It is interesting to note that most of the children with craniotabes were in good condition. Some of them being over weight.

The fact that most of the cases studied were in breast fed children would point toward the assumption that craniotabes is most prevalent in breast fed, and is influenced by artificial feeding. One of the cases in which craniotabes appeared between the sixteenth and seventeenth month was on breast feeding at the time. I had a number of cases that were weaned by the mother against my advice, and, remarkable enough, the craniotabes disappeared right after the children were put on artificial food. R.R. for instance, had craniotabes at 3 months, becoming more marked at 4 months, but at 4½, when put on a cereal it disappeared and was still absent at the seventh month. O.J. had craniotabes up to 6 months, and when put on a cereal it disappeared.

As to the orange juice, I saw no effect on craniotabes from it. In three cases it seemed that the craniotabes disappeared earlier, but rosary and epiphyseal enlargement followed. Cod liver oil has given results in four cases, as explained above, but as a rule the results were not striking.

#### CONCLUSION

Of 760 colored babies that have been studied, craniotabes was detected 415 times in 162 babies. Counting cases and not observations this gives a percentage of 21.

The craniotabes observed may be classified in two types: (a) in which the bone has a soft boggy sensation, and which extends over a large portion of the skull; and (b) in which a small portion of the bone caves in giving rise to the well known parchment like crackling.

The greatest number of my cases were in breast fed children, only 15 in mixed feeding and only 23 in artificially fed. Figuring

the times observed, and not cases, the number of craniotabes in artificially fed is still further reduced, the figures being breast fed 342, mixed 42 and artificial 31.

The age incidence ran as follows: The craniotabes started in between the ages of 1 and 2 months, most often in the second month. It reached the height of development at the fourth month and disappeared between the seventh and eighth months, even though no cod liver oil or orange juice was given.

Both sexes were about equally affected, there being only a slight preponderance in favor of boys.

The location of craniotabes was mainly parietal, at times also temporal, seldom occipital. The greatest number showed bilateral involvement. Where one side was affected, there was a preponderance of craniotabes on the right side, the posterior portion of the parietal was more often affected, especially in the type that gave a crackling of the bone.

In all but 5 cases, craniotabes was followed by the development of rosary and epiphyseal enlargement. In none of the cases could I see any relation between craniotabes and lues.

Orange juice in small or large doses had no effect on craniotabes.

Cod liver oil seemed to have a favorable effect on the disappearance of craniotabes in only 4 cases.

There was no relation between craniotabes and the general condition of the infants, most of the children with craniotabes having been in good condition.

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CONGENITAL CYANOSIS (Bulletins de la Société Médicale des Hôpitaux, Paris, Jan. 30, 1920). Variot and Bouquier state that within a recent ten days four newly born infants with congenital cyanosis died when they were from 10 to 15 days old, and necropsy showed a widely patent arterial canal with congestion of the lungs and emphysema, as with death from asphyxia.—*Journal A. M. A.*

# ACUTE OSTEOMYELITIS IN CHILDREN.\*

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Philadelphia.

As a basis for this paper, 35 cases have been collected from the records of the Surgical Service of the University Hospital covering a period of slightly more than 10 years. Many cases of essentially chronic character have been excluded, but 4 cases have been included which had become subacute by reason of discharge of the abscess, either spontaneously or by incision by the attending physician, the first formal operative procedure being carried out after admission of the patient to the hospital. Several of these cases were my own. The remainder were operated upon by various members of the Surgical Staff. To them I express my obligation and to Dr. John B. Deaver, John Rhea Barton Professor of Surgery, my grateful acknowledgment for permission to use the material.

There were 14 males and 11 females, varying in age from 16 months to 15 years, with an average age of 10 years and 1 month. There were 6 below the age of 5 years, 12 between 5 and 10, and 17 between 10 and 15 years. The disease therefore is seen to be more frequent in males and though it may affect the infant it finds its greatest incidence in the later years of childhood.

The sites of bone involvement were as follows:—

Tibia—lower end .....	10
“ upper end . . . . .	1
“ entire shaft .....	3
Femur—lower end .....	7
“ upper end .....	5
Fibula—lower end .....	2
“ entire shaft .....	1
Humerus—lower end .....	1
“ not specified .....	2
Ilium .....	22
Radius .....	2
Ulna .....	1
Phalanx .....	1
Os calcis .....	1
Jaw .....	1

\*Read before the Philadelphia Pediatric Society, March 13, 1920.

Three cases (9 per cent.) showed multiple involvement as follows:

CASE No. 26, jaw, humerus, radius and ulna.

CASE No. 29, radius and femur.

CASE No. 35, fibula and both femurs.

As a focus of this disease, the long bones greatly predominate but any bone which possesses a spongy medulla may become the seat of a typical osteomyelitis. The diploe of the skull, the bodies and spines of the vertebrae, the spongy interior of the scapula, especially of its spinous process, and even a sesamoid bone such as the patella have been reported as primary seats of osteomyelitis. In this series the tibia was involved slightly more often than the femur. In most large collections, the femur leads the list with the fibula a close second.

In considering the etiology of osteomyelitis, one must speak in terms of infection and immunity. That the disease is always an infection needs no reiteration. In this series, as in all others, the most common infecting microorganism was the staphylococcus aureus. In 2 cases, the streptococcus was found alone and in one it was combined with the staphylococcus aureus. While no instance was found in this series, other coccus infections are not uncommon, particularly the pneumococcus and staphylococcus albus and may be quite as serious as those due to the more common organisms. Bacillary infection also occurs, notably with the typhoid bacillus. These infections are apt to be less fulminating and severe than the coccus infections.

As in many other infectious diseases, the depreciation of the immune forces of the body play a considerable rôle in predisposing to the attack. These factors cannot be accurately estimated but may be surmised in the many notes on physical examination that the child was undersized, undernourished, anemic or rachitic. Occasionally, however, it is noted that the child was robust and in perfect health. Even in these cases, we have no means of knowing that there was not a natural weakness of immunity or a temporary depression of resistance to specific infections.

In about one-third of the cases, definite suggestions as to portal of entry were noted. It is obvious that osteomyelitis is a hematogenous infection. It is equally certain, therefore, that bacteremia must precede localization. The source of the bacteria

in many cases may be surmised with a great degree of probability. Antecedent conditions of apparent importance are tonsillitis, pharyngitis and other oral infections, bronchitis, influenza, pneumonia, gastric and enteric disturbances, helminthiasis, pustular conditions of the skin and minor infections of traumatic origin.

It may be assumed also that many of the febrile disturbances of children, which are of short duration and usually not dignified by a diagnosis excepting a popular tag for family consumption, are associated with a transient bacteremia, for it has been demonstrated that bacteria enter the circulation much more frequently than was formerly supposed.

Added to those factors of general import are certain conditions which induce local implantation of the circulating infective agents. In this series, 15 (43 per cent.) gave a direct history of traumatism as follows:

Fall .....	8
Struck on leg .....	2
Hurt jumping .....	2
Hurt running .....	1
Hit by trolley .....	1
Kicked by horse.....	1

Trauma acts by internal injury of the bone. Force of sufficient violence applied to a bone breaks the dense cortical layer and produces a fracture. Force of insufficient violence to produce fracture may yet injure that marvellous system of arches and cross braces which give to the spongy bones their strength combined with lightness. As has been pointed out, these arches and braces develop along and in answer to lines of strain. Sudden force with quick deformation of the medullary arches can injure and even fracture these delicate supports without fracturing the cortical bone. This can happen most easily in childhood, when the cortex is elastic and yielding.

Moreover, during the period of growth, the bone immediately adjacent to the epiphyseal cartilages is young and delicate and most susceptible to trauma. It is well known that in the vast majority of cases acute osteomyelitis begins in the shaft of the long bones near the epiphyseal plate, a region known as the metaphysis. Lexer has beautifully shown the great richness of the blood supply in this region, most of which comes not from



the nutrient artery but from vessels which encircle the growing end of the bone and send branches of considerable size directly to the epiphyseal plate and the adjacent medulla. These branches break up into numerous wide capillaries in which the blood current is slowed and ample opportunity given for the interchange of metabolic substances upon which the growth of the bone depends.

Langer, in his work on "the growth of the human skeleton," has established certain figures which he speaks of as the "growth coefficient." These represent the relative ratio of growth of the bone from the various epiphyses. The bones possessing the highest "growth coefficients" are the femur and the tibia. These are the bones chiefly affected by osteomyelitis. Also, as Klemm has shown, in the same long bone the most common site of the infection is at the end possessing the most actively growing metaphysis. Occasionally the epiphysis is the seat of the primary lesion. Here the anatomical conditions closely resemble those of the metaphysis. Formerly typical osteomyelitis was often called epiphysitis under the impression that the epiphysis was the primary focus, a natural error owing chiefly to the location of the infection at the end of the bone. True epiphysitis, however, is prone to extend into the joint rather than into the shaft. For this reason it has been called "joint osteomyelitis." A particularly dangerous form of this condition is the infection of the upper end of the femur leading to suppuration within the hip joint.

Another point of interest in connection with true acute epiphysitis is in the fact that the "chain" cocci, the streptococcus and the pneumococcus appear to have a predilection for this portion of the bone, the preponderance of the staphylococcus infections in this location being less marked. This fact also indicates that there are probably other reasons than the anatomical for the localization of the metaphysis infections, such for instance as oxygen tension, tissue chemotaxis, etc. At any rate the typical sequence is as follows: lowered general resistance, chronic or temporary, a focus of infection, bacteremia and arrest and localization of the microorganisms in an area of traumatic inflammation in the end of a long bone. One or several of these typical conditions may be lacking or modified in the individual case.

The clinical results or symptoms of this process are extraordinarily varied. The stage of infection or bacteremia may hold

the leading rôle for a time. In 2 of this series, the symptoms for the first 24 hours were those of a severe general infection. There was no pain or other evidence of localization. In one of these cases localization occurred in the lower end of the tibia which had been hurt by a fall one week previously. This patient perished from sepsis on the 31st day of the disease in spite of incision and drainage of the lesion on the third day and total excision of the diseased shaft two weeks later. In the other case, pain developed in the hip which had been injured playing football, and the course of the disease was most severe, though recovery eventually took place.

Ordinarily pain is the initial and most prominent early symptom though constitutional evidences of infection are present, and rapidly increase, often in alarming fashion.

Fever, rapid pulse, leucocytosis, often chills and sweats and other general symptoms of pyogenic infection are the rule. The local symptoms and signs of inflammation increase *pari passu*. Effusion is frequently noted in the neighboring joint. In a few days one or more fluctuating abscesses of the overlying soft parts may form and the inflammation will often extend throughout the length of the bone. The further course of the disease, if not subjected to radical treatment and provided that the patient escaped the special perils of sepsis, is that of discharge of the abscess of the soft parts with continuance of suppuration of the affected bone and adjacent tissues, sequestrum and involucrum formation with the development of chronic sinuses that remain open or heal only to break down with renewed suppuration. Such cases often drift from hospital to hospital seriously incapacitated and their life expectancy cut short by continuous absorption of septic products.

In addition to these acute and ultra acute types of the disease, there are those of milder course. The systemic symptoms may never be alarming and the local symptoms and signs of only slight degree. Yet death of the bone and sequestrum formation may occur. Cases of albuminous, or gelatinous effusion have been reported. A small infective focus may be localized and encapsulated within the medulla as in the so-called Brodie's abscess. It is characteristic of all disease processes to range from the most acute manifestations down to the almost if not quite unrecognizable cases. Osteomyelitis is no exception. There were 3 cases

of pathological fracture of the femur in this series, 2 of which, an unusual number, are due to this mild type of the acute disease. Case No. 17, a boy, aged 10 years, complained of pain in the hip in July, 1912, and was treated for rheumatism. In August, 1912, he fell and from slight violence sustained a pathological fracture of the right femur. The fracture was plated and the wound promptly broke down. Six months later a sequestrum was removed.

It has been noted by Schlange and others that organisms can be recovered by culture from such chronic foci and this was doubtless the source of the infection. Case No. 34 was almost exactly similar.

Notwithstanding the occurrence of the mild forms of the disease, it should be thoroughly understood that cases of mild severity are a rarity in pyogenic osteomyelitis. It has often been pointed out that the body is at great disadvantage in dealing with suppuration within a bone, that extension is the rule and absorption of infective products rapid and dangerous. Bacteremia is a common accompaniment or sequel. Klemm obtained a positive blood culture in 40 per cent. of his large series of 269 cases.

The mortality in the present series was 14.3 per cent. One patient died of septic pneumonia and 4 of the toxemia of sepsis. A large number were desperately sick and barely escaped with their lives. Excluding the cases that died, the average duration of treatment in the hospital was 5 months. In spite of this prolonged period, only 4 cases were discharged cured. The remainder were sent to the Seaside Home or to their own homes to be treated as ambulatory cases. Unquestionably, in a fair percentage of these cases, still more months elapsed before complete cure and in some cases further operative procedures were necessary. It is not within the scope of this paper to speak of the many complications and sequels of chronic nature to which this disease may give rise. Suffice it to say that 5 patients had lost the entire shaft of the affected bone. Three had lost, to a greater or less degree, the function of the knee, 1 of the hip and 1 of the wrist joint through suppurative arthritis.

There is no disease of which it can be said more truly that the treatment is wholly surgical. Medical treatment of the patient there may be, but not of the disease itself in our present limitations of antitoxic and antibacterial therapy. The physician has

but 2 functions, namely to recognize the condition and to institute surgical treatment. The earlier the operation the better the outlook for life and limb. An unskillful operation that provides drainage early is often better than all the resources of surgery applied later.

What do we find? In the most pronounced acute cases the average delay in admission to the hospital was 9 days, ranging all the way from 2 to 21 days. It is clear that either the diagnosis is extraordinarily difficult or that the profession is not acting on the belief that acute osteomyelitis is an emergency condition. It must be admitted that there are difficulties in diagnosis. In this series it was specially noted that over  $\frac{1}{3}$  of the cases had been erroneously treated on a mistaken diagnosis. Six were treated for rheumatism, 4 for "abscess," 1 for dislocation and 1 for fracture. The truth of the matter seems to be that, the disease being relatively uncommon, it catches the physician napping. There should be no reason to attribute the local condition to sprains, fractures or dislocations even with the usual history of trauma, since the systemic and local symptoms clearly point to infection. The most frequent and insidious error is to consider the affection as a disease of the joint or of the soft parts. The effusion into the joint, the periarticular swelling, the rapid formation of abscesses pointing superficially, in short the striking external evidence of infection that quickly appears in acute cases diverts attention from the bone as the primary seat of the trouble. To avoid error and undue delay, it is necessary to regard as osteomyelitis all acute febrile cases especially in children who have pain and inflammatory changes in the region of an epiphysis. This is particularly true of the femur and tibia. Careful examination will usually eliminate the joint and verification may be secured by puncture. The x-ray fails to show early bone changes in osteomyelitis and is useless in diagnosis in the critical stage.

The essential object of early treatment is prompt and efficient drainage of the affected medulla. The surgical error, that is frequently committed at operation in the acute stage, is to incise and drain the soft parts and the periosteum leaving the bone unopened. It is true that certain cases are relieved by this simple procedure and escape necrosis of the bone. There is 1 such case in this series in which the patient was operated upon on the second day and the incision carried down to the bone at the

lower end of the tibia. No pus was found. The wound subsequently discharged profusely but no sequestrum was formed. On the other hand, 3 of the 5 fatal cases were operated upon on the third day and 1 other fatal case on the fifth day by simple incision and drainage. This, it will be observed, was the initial operation in 4 or 5 fatal cases. In 2 cases, death occurred from sepsis on the fifth and thirteenth days respectively after operation. In a third case, the infection extended throughout the entire length of the shaft of the tibia which was excised 2 weeks later, death occurring in 2 weeks from a continuance of sepsis. In the fourth case, the infection extended throughout the fibula and the right femur and left femur successively became involved, death ensuing finally from toxemia. It is obvious that efficient drainage of the medulla cannot be secured by incision which reaches only to the cortex. It is established that these pyogenic infections originate in the medulla. Therefore, to fail to open the bone is to invite local extension and general sepsis. Often an extensive collection of pus will be found under the periosteum and the beginner will be deceived, believing that the condition is suppurative periostitis. Actually, this pus has come from the interior of the bone, making its way out through the vascular channels and along the epiphyseal cartilage.

The bone therefore should be opened in every case. It is best not to be content with a simple trephine or burr opening but to remove the cortical bone over the medulla for a distance of 2 inches in the case of the long bones and, if microscopic evidence of infection is still visible in the marrow, the bone incision should be carried beyond that point. There is much more danger of making the incision both in the soft parts and the bone too small, rather than too large. Large incisions properly placed do not incapacitate. Insufficient drainage and infective necrosis often produce irremediable damage. The marrow should not be curetted away in the acute stage. If exposed freely, it will drain itself and necrosis will be limited to a minimum.

The opening thus made should be packed with paraffin gauze and, on removal of this pack on the third to the fifth day, Dakin's solution may advantageously be used to limit superficial infection and the absorption of toxic products. If the bone fortunately has not undergone necrosis, sterilization and closure will be a relatively simple and speedy matter. If necrosis has occurred,

we find ourselves in a field of surgical possibilities too wide for discussion at this time.

The outstanding features of the subject of acute osteomyelitis which deserve emphasis are:—

1. Acute osteomyelitis belongs to the domain of emergency surgery.

2. Present experience shows too often errors in diagnosis, delay in treatment and insufficient primary operative procedure.

3. With due allowance for individual resistance and virulence of infection, the mortality and morbidity of this disease vary inversely with the promptness of diagnosis and treatment and directly with the efficiency of drainage at the primary operation.

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TUBERCULOUS OTITIS MEDIA (*Journal of Laryngology, Rhinology and Otology*, London, April, 1920). Among 79 cases of chronic suppurative otitis media in which the casual condition was noted, Dr. Guthrie found 13 cases of tuberculous origin. The mode of feeding was noted in 11 cases and in 9 of these unboiled milk was used. Hence, it appears probable that the tuberculous infection is primarily implanted in the nasopharynx, whence it is conveyed to the middle ear by way of the eustachian tube.—*Journal A. M. A.*

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ACUTE ENCEPHALITIS IN CHILDREN (*Bulletins de la Société Médicale des Hôpitaux*, Paris, Feb. 6, 1920). J. Comby warns that acute encephalitis is frequent in children but is usually mistaken for tuberculous meningitis until lumbar puncture shows the absence of lymphocytosis. In his 25 cases published in 1907 the lethargic type was manifest in about a third of the cases. The encephalitis developed secondary to influenza, whooping cough, vaccination, enteritis or gas poisoning in the majority, but in some the disease seemed to be primary. Some of the children died and some recovered completely, but others were left with grave sequelae.—*Journal A. M. A.*

## INFANTILE SCURVY.\*

By JOHN AIKMAN, M.D.

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Within the last few years a large amount of literature has appeared in medical and other allied scientific journals on scurvy, largely dealing with the relation of certain foods to its prevention or its production. Two factors have entered largely to stimulate this work: 1st, the discovery that the disease could be produced in certain lower animals, especially in the guinea pig and in the monkey; 2nd, the late war. Although reports are scattered and incomplete, there was, no doubt, a great deal of scurvy in Europe during the war and much work was done in this and other countries to find proper preventatives. All these investigations are of a certain amount of value to us as practicing physicians and it is my object to attempt to bring together and group the facts that seem most essential.

The modern work on scurvy has been done in so many laboratories and by so many investigators that I will not attempt to give credit to each individual for the portion of his reports that is presented. The investigations of the disease in early infancy in the human race are of more interest to us than experiments on lower animals, but, while it is dangerous to translate guinea pig findings to human beings, much of this laboratory work is of value in bringing out the relative value of foods. There is more difference of opinion and of reports in the animal experimental work because there is some question as to just what constitutes scurvy in guinea pigs, some contending that much of the so-called scurvy is in reality rickets. While this makes some confusion, a comparison of the different findings brings out certain facts that are of value to the physician in his every day work. At the present time we will consider only the points that seem of practical clinical value.

Scurvy, as we know it today in civil life in this city, is largely confined to infancy, there being very few cases in adults, due to the ease with which fresh fruits and vegetables may be obtained throughout the year. The scurvy as reported in history and as it is found in some other parts of the world today is a terrible disease, especially when certain crops on which the people largely

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\*Read before the Rochester Academy of Medicine, December 10, 1919.

depend fail, or on the long sea voyages of sailing vessels. Due to inability to secure the proper foods, the disease progressed to a most dangerous form, accompanied by a high mortality.

The typical infantile scurvy which has been described in all text books for years is well brought out in the following history: Arthur J., age, 11 months, of Pavillion, N. Y., was first seen on January 31, 1917. The child was born at full term, delivery normal. The mother died soon after his birth and he was fed on condensed milk and later on a proprietary high sugar food and water. He had never had any raw cow's milk or fruit juices. He had gained weight up to some time back, constipated, cut teeth slowly.

*Previous Diseases.* None.

*Present History.* Two months ago became irritable, lost his appetite and lost the use of one leg, then later the use of his other leg. Began to run a temperature. There was no vomiting. Became tired if moved. Had passed a small amount of blood in the urine. Had bleeding about teeth. Sweated a great deal. Had not gained weight of late.

*Physical Examination.* Anemia. Pasty male child with a few ecchymotic spots on the skin. Weight, 12 pounds. Circumference of head, 43 c.m. Chest, 39 c.m. Abdomen, 32 c.m. Eyes, normal. Teeth, 2 upper, 3 lower. Gums, swollen and bleed easily. Slight beading of ribs. Heart and lungs negative. Both legs very swollen and very tender. A diagnosis of scurvy was made and the child was placed on an antiscorbutic diet. Good recovery followed in a few days.

This is the well known picture:—A history of long feeding with improper foods, especially the use of condensed milk without whole milk or fruit juices. The pain on motion, loss of function and swelling of the legs, the ecchymosis, bleeding gums and hematuria are also typical.

The newer findings bring out much in addition to the above and in order to cover the field we will take up the points by etiology, symptoms, etc., leaving out the pathology of the condition.

*Etiology.* Two schools have developed as to the cause of scurvy. One claims that scurvy, rickets, beri-beri and pellagra are deficiency diseases and that certain substances, known as vitamins, are lacking. Just what vitamins are no one knows,



although some of their properties have been worked out. The other school holds that scurvy is of toxic origin and is either an intoxication or autointoxication due to the overgrowth of harmful bacteria in the intestinal tract.

I think that the strongest evidence points to the deficiency theory, although there is much that points to a metabolic disturbance being present that sometimes makes an animal unable to utilize well established antiscorbutics.

It is demonstrated that the vitamins are frequently stored in the body and delay the onset of scurvy after a vitamin-free food has been given for some time. Also that vitamins are not stable toward heat. Both of these points are important from the clinical side, one explaining the late onset of scurvy, usually in the third quarter of the first year of life, the protection being provided by vitamin received at birth from the mother; the other explaining why so many foods, if given alone, without an antiscorbutic, will cause scurvy.

Let us now review the foods that will cause scurvy. Of greatest importance to us is the relation of modern research to milk because no food is so much under investigation at the present time and no food is as necessary to the young infant. With milk, as with many other foods under investigation, a wide difference of opinion exists.

A few cases of scurvy are reported by Finkelstein and others as having occurred after good feeding and prophylactic care, but clinical histories are usually quite uniform in showing that there has been a deficiency of vitamin-containing foods in the diet.

It is found that breast milk or cow's milk, with rare exceptions, will prevent scurvy.

All investigations show that raw whole milk contains a relatively small amount of vitamin and that it requires at least one pint of fresh raw milk daily to protect an infant. This small amount of vitamin can be easily reduced by heating and thereby cause a child to approach recognizable scurvy. There is no doubt that changes in the metabolism of the child must take place long before the symptoms of scurvy become evident to the clinician.

The farther we remove the diet of a baby from fresh raw

milk the more likely is scurvy to develop, unless an active antiscorbutic is added to the diet.

It is quite conclusively shown by Hess and others that pasteurized milk is an incomplete food and can produce scurvy. Hess had an excellent opportunity to watch a large group of infants fed on a pasteurized milk diet and the fact that so many of these children developed scurvy enabled him to study the disease very carefully from every side and to add much to our knowledge of scurvy in infants.

The age of milk is claimed to be a factor in relation to vitamins. Stale milk contains less of these elements than fresh milk and fresh milk boiled, contains more vitamins than stale milk, pasteurized. This brings up the point that pasteurization should not be used to save stale milk, if it is to be fed to infants. Pure fresh raw milk still remains the best food for the human infant.

Condensed and evaporated milks are apt to produce scurvy, unless an antiscorbutic is given. I feel that condensed milk is today, in the hands of the laity, a most dangerous food for infants. Other proprietary foods containing milk that has been heated are apt to produce the disease. The same can be said of malted milks.

The only prepared milk food that escapes this criticism to any degree is dried milk. The earlier preparations of dry milk were devoid of antiscorbutic principles. The later preparations are made by heating very fine particles of milk to a temperature of 116° C. for about 1 minute. The milk is forced through very fine holes into a hot chamber producing a fine spray which is immediately dried. This milk retains the vitamins to a considerable degree, even after a few months and has cleared up a few cases of scurvy. If it were absolutely impossible to secure a good fresh milk, the dried milk might be used with a fair degree of safety. Under any other circumstances, it is better to give whole raw milk. Schloss milk and Keller's malt soup will produce scurvy if used alone.

This takes me up to the other proprietary foods. Without an antiscorbutic in the food, any of these preparations are apt to produce scurvy. In this respect, we must be careful not to accept the reports given unless we first look into the matter carefully. This is especially true if the reports are made by those benefitted

by the sale of such foods. We must be extremely cautious, if not skeptical, as to the antiscorbutic values in the preparations.

This fact was well demonstrated by a child recently examined. The child had never been breast fed and the parents, following the advice of friends, put the child on a widely advertised infant food. To make sure that the child would be properly fed and also to avoid the expense of medical advice, the parents communicated with the food company and received at various times minute directions as to the feeding of the child. Had the food company acknowledged their preparation to be deficient and advised an antiscorbutic, things might have turned out better. As it was well marked scurvy developed which cleared up as if by magic on raw whole milk and orange juice.

The age of the food after production, the age of the milk or other vitamine containing food before its manufacture, the degree of heat to which it is subjected, the length of time after manufacture before the experiments have been conducted, and a multitude of other factors must be taken into consideration. Any physician who takes the trouble to investigate the matter will find that a surprisingly long average period elapses between the time when these foods are manufactured and the time when they are in the hands of the ultimate consumer. Results of experiments showing that a freshly prepared food of any nature might contain vitamins are no proof that the food you will order will contain the same amount. Neither are the histories quoted to be entirely relied upon as an antiscorbutic may be given at the same time and seem too unimportant to be mentioned. A good example of this was a perfectly normal 1 year old baby that was shown to a mother to induce her to change to malted milk, it being stated that the child had been brought up on that food. I had an opportunity to question the mother and learned that the child had received a liberal amount of breast milk over this whole period. Yet this mother would give a testimonial as to the value of malted milk as an infant food.

Fresh fruits and vegetables have long been known to prevent scurvy and modern investigators have studied deeply into the relative values of these foods. They have tried to develop some method of preservation that would protect the food for months and at the same time not destroy the vitamine content.

Of the foods, orange juice is the most popular antiscorbutic,

being 10 times as active as fresh grapes. It can be boiled for 10 minutes and still retain its value. If rendered slightly alkaline by sodium hydroxide, it may be given intravenously. Orange peel also has a high vitamine content.

The physiological department of the University of Rochester has succeeded in putting orange juice through the same process that is used to produce dried milk. A residue is produced that will prevent scurvy and which has a favorable influence on animals having the disease. This preparation was good after 100 days. If it proves of worth to children, it will be very valuable, as it will not cost as much as fresh fruit.

Artificial orange juice is of no value. Lemon juice is better than lime juice and is of value after the citric acid has been removed. Bananas and prunes contain very small amounts of vitamins.

Of the vegetables, potato, boiled or mashed, is valuable. Cabbage, onion and swede can also be used. Carrots and beet juices are reported as having a low vitamine content by some and a high amount by other writers.

A food that is of exceptional value is the juice of canned tomatoes. One ounce given daily to an infant will prevent the disease. As much as 6 to 8 ounces have been given to a child. Age of the product seems to count but little in the value of this food. It is cheap and is recommended by Hess for use in institutions.

Attempts have been made to dehydrate or desiccate vegetables and still retain appreciable amounts of vitamins and, while some claim success, more seem of the opinion that desiccation destroys the value of the food as an antiscorbutic.

Stefansson, the Arctic explorer, a keen, practical observer, draws from his years of experience interesting conclusions. He found that antiscorbutic qualities reside in certain fresh foods and diminish or disappear by storage or by common methods of preservation, canning, pickling, drying, etc. Desiccated potatoes and bottled lime juice were of little or no value. He decided that cooking destroys the antiscorbutic value of most foods. Raw or even putrid meat was of more value than cooked meat. Body cleanliness and ventilation of living quarters were of little value as preventatives.

Yeast and the germ of wheat are of no value. Some claim

that pulses, allowed to soak for 48 hours until they sprout, are of value if given with the sprouts. Butter, fat and cod liver oil are of no value.

Much has also been learned regarding the symptomatology of scurvy. We have reviewed a typical case of advanced scurvy but it has been shown that long before these advanced symptoms occur there are changes taking place in the infant that can be detected clinically if one is on the outlook for the condition.

Most often children show a failure to gain in the third quarter of the first year, or they show a loss of weight. This is accompanied by loss of appetite, pallor, a muddy complexion and beginning tenderness of the bones. The respiration and pulse are increased and there is dilatation of the heart, especially of the right ventricle. This latter is shown by the x-ray. Some few children continue to gain, but this is uncommon. Growth and length are retarded and this retardation is not dependent on the caloric value of the food. The weight and growth pick up quickly when antiscorbutics are added to the diet.

Edema of the eyelids and of the lower ends of the tibias may be present.

The children are especially susceptible to infections of all types and frequently develop eczema.

Some of the above symptoms are, no doubt, present in every child that develops scurvy long before the disease becomes typical. They constitute what is known as latent or subacute scurvy. The disease may be held at this point by very small amounts of vitamine, too small to completely clear up the condition as with pasteurized milk; or it may be long delayed in progression to true scurvy by vitamines stored in the body, those received from the mother at birth or from previous vitamine containing foods. It may remain at this stage, or by continued poor feeding, or the presence of some acute infection, become florid. Many cases stop at this subacute stage because it is the custom to add orange juice at about the eighth month.

In the face of the findings reported, we should be willing to admit that there is such a condition, that it is probably quite common, and that in a large majority of cases we are not making this diagnosis. No doubt later laboratory methods will be devised to detect the disease earlier in its development, but until such

methods are devised, we must resort to conclusions drawn from the history and slight physical findings.

After making the diagnosis of latent scurvy, we must follow up the treatment until the diagnosis is either proved or disproved.

The prognosis of scurvy is very good, as the large majority of cases yield very promptly to proper treatment, but in the advanced cases it is more serious.

The disturbed nutrition, the prolonged exhaustion from pain and the frequent presence of gastrointestinal disturbances produce a fairly high mortality. Still reports 5 deaths out of 64 cases.

*Diagnosis.* The diagnosis of well developed scurvy is not difficult, but the diagnosis should be made before all the old classical symptoms develop. The danger of waiting for classical symptoms to develop, before a diagnosis is made, is shown by the following case. B. F., age 10 months, had always had good care and had been fed on pasteurized milk. Orange juice had been ordered, but as the child refused to take it, none had been given. The child had been getting pale, pasty, irritable and cried a great deal. Would not sit up and did not want to be handled. Was previously diagnosed as a "weak child."

*Physical Examination.* When I first saw the child he showed signs of rickets. The gums and skin were normal, but both legs were tender. The child cried when moved. The condition was considered serious by the parents, but antiscorbutic treatment cleared up the symptoms in a few days. An earlier detection of the onset and of the prodromal symptoms would have saved much suffering. The only classical symptoms were the tenderness and limited motion.

It should now be possible to make a diagnosis before the child lies as if paralyzed. If diagnosed early, swollen, bleeding gums with a blue line will rarely be seen even if we examine back of the teeth. Swelling of the limbs will not be marked, there will be little ecchymosis and hematuria will not be marked. Still it is to be remembered that some few cases show some of these signs very early.

A 10 months old baby, seen on July 21, 1919, is a good example of the absence of some of the classical signs we have been led to expect. The history of the child up to a few weeks before had been perfectly good except for a little feeding trouble. The child had just 2 weeks of breast feeding and after that time was

on malted milk. No antiscorbutic had been given. A few weeks back he lost his appetite, was very irritable and failed to gain in weight. Brought into my office because he cried continually. Physical examination showed a very pale child with well marked rickets, slight edema and moderate tenderness over the tibias and some loss of motion due to pain. The child had no skin changes and the gums and teeth were normal. One day on antiscorbutic treatment gave great improvement and by July 24, the mother reported that there was no tenderness. The appetite improved in a few days and the anemia cleared up after a few weeks.

The bone changes are not extreme and infractions are rare in the latent form. Slight bone changes appear fairly early and the x-ray is of great value in making a diagnosis.

The following case is interesting because of the diagnosis of scurvy following a fracture: F. C., 14 months of age, seen at General Hospital, O. P. D. 3 days after the child had fallen from his sister's arms to the floor.

*Family History.* Negative.

*Previous History.* as given on admission, was good, the child having been fed on the breast and on cows' milk.

*Physical Examination.* Well developed and nourished, cries as if in pain, especially when moved. Fontanelle,  $1\frac{1}{2} \times 2$ , open. No craniotabes. Eyes, ears, nose and mouth normal. Tonsils large, heart normal, chest shows marked rosary, lungs show few râles. Abdomen negative, except for umbilical hernia. Joints and extremities: Right leg shows marked swelling about femur, limitation of motion and extreme tenderness. No false motion detected. Referred to x-ray and to surgical clinic. A diagnosis of fracture at the middle third of the right femur was made and he was admitted to the house for treatment.

After due time the case was discharged cured. Seven weeks after the first admission the child was readmitted to the O. P. D. with a history of a return of pain on being handled. The mother then admitted that for a long time she had given the baby nothing but boiled milk and that the child had had no fruit juices. This was much different from the first history.

*Physical Examination* showed the right leg still very tender.

*Diagnosis.* Scurvy. Antiscorbutic treatment was administered with recovery in 6 days.

The child probably had latent scurvy on the first admission;

the relation of this to the fracture is problematical. Good food in the ward held the condition in check and a return to the former home diet promptly caused a development of florid scurvy. If we had been on the outlook for scurvy, bone changes might have been detected when the x-ray was made.

I saw one other case in the dispensary that gave a good history of feeding but which had signs of rickets and latent scurvy with slight tibial tenderness. The history was found to be false and the diet had contained no antiscorbutic. The tenderness cleared up but the child later developed a gastrointestinal attack. When last seen, the anemia, pasty skin, loss of appetite, irritability, etc., were still present. The gastrointestinal attack was so severe that no antiscorbutic treatment was given for some time and the subsequent history is unknown. The susceptibility to gastrointestinal attacks and the poor home care make the complete cure of some of these cases difficult.

Slight hematuria is a very early symptom and a microscopical examination is of great value. Some few cases start with a more marked hematuria.

It is advisable to watch closely for scurvy in children on a diet known to be deficient in vitamins and to at once institute proper antiscorbutic treatment if the condition is suspected.

Except in institutions where scurvy is developing in a number of children on the same diet, it is very difficult to prove that the diagnosis is correct unless tenderness, hematuria or bone changes can be detected. But with the symptoms of latent scurvy in mind, we can feel safer in making a diagnosis if slight tenderness or one of the other symptoms is present. Also, we can suspect this condition as being present in children lacking the old classical symptoms but giving the other evidence of scurvy, and, by instituting proper dietetic treatment, improve the general condition.

I have seen a number of children with a history of poor diet and who showed some of the symptoms enumerated. These children showed improvement following proper treatment, but I cannot prove that the cases were not simply those of malnutrition and anemia that cleared up under proper hygienic care.

Before we leave diagnosis, it might be well to just mention the diseases with which scurvy is often confused. Rheumatism: As Kerley says, "the age for scurvy is not the age for rheuma-



tism." Poliomyelitis: One of the cases I have cited had been thus diagnosed. Multiple neuritis, syphilis: If doubtful a Wassermann reaction will clear up the diagnosis. Koplik reports a case in which the hemorrhages of the bowel were mistaken for intussusception. He also warns that scurvy be watched for in cases of enteritis that pass pure blood. Osteomyelitis, periostitis, joint or spinal diseases must also be considered. One of the above cases had been diagnosed as "hip joint disease."

*Treatment.* All that we need say about treatment has been already mentioned in our discussion of foods. The disease may be prevented by a close supervision of the diet of the child and the administration of an antiscorbutic, if sterilized food has to be given as the chief article of the diet. Early administration of orange juice, at 6 months or before, is to be advised, if sterilized food is to be given. Tomato juice may be used, if oranges are not available. The same foods are to be used in the treatment. In time, no doubt, dried orange juice will be available. In no disease is recovery more spectacular than in scurvy. A few days change an irritable, sickly child into a well infant. All that is necessary is the diagnosis followed by proper diet.

184 *Alexander Street.*

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PROPHYLAXIS OF WHOOPING COUGH (*Nederlandsch Tijdschrift v. Geneeskunde*, Amsterdam, Jan. 10, 1920). W. F. Enklaar suggests that contagion of whooping cough and possibly of measles might be prevented by arranging the classes according as the children have had the disease or not. If a case develops in a school room, those who have had the disease can continue at school, but the susceptible should be kept at home until the danger of contagion is past.—*Journal A. M. A.*

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JUVENILE TABES (*The Lancet*, March 13, 1920). Kerr's patient was only 14 years of age. The three striking features of the case: (1) lightning pains, (2) primary optic atrophy, (3) absent knee jerks, established the diagnosis of juvenile tabes in spite of the absence of a history pointing to hereditary syphilis and of the negative blood and cerebrospinal fluid Wassermann.—*Journal A. M. A.*

## CLINICAL DEPARTMENT

CASES CONTRIBUTED BY

H. MERRIMAN STEELE, M.D., New Haven, Conn.

NATHANIEL BARNETT, M.D., Woodmere, New York.

CASE NO. 5.\* V.M.S. Age, 12 months. Weight 17 pounds. Was brought to my office with the complaint of "off and on protrusion of the right eye," and "rheumatism of the legs and feet."

She was the only child of the father's second marriage, and she had a half brother 12 years old. Both the father, mother and brother were in good health and gave a complete negative family history. Full term, normal birth, birth weight, 4 pounds. She was nursed 2 weeks when, the mother's milk failing, she was put on malted milk. This feeding continued until 1 month before I saw her when, at 11 months of age, the feeding was changed to Mellin's Food mixed with pasteurized cow's milk. Her digestion had always been good, her bowels regular, and beyond her slow gain the mother had noticed nothing wrong until the present illness. The onset was with swelling of the legs and pain on handling and had been treated as rheumatism. On question the mother reported at one time the right knee looked "a bit black and blue." At this same time the right eye was noticed "bulging." The eye condition lasted only a day but has been repeated twice and is present at the time of my examination. The baby has been very quiet and only in pain when moved for dressing or the legs rubbed with some ointment prescribed for the rheumatism.

Examination showed a small, undernourished, anemic baby. She lay perfectly quiet when undisturbed and her right leg demonstrated a pseudo-paralysis. The slightest touch elicited a sharp, painful cry as did the slightest movement. The approach of the hand to examine or dress her caused distress as evinced by crying through apprehension. There was no attempt to grasp objects or to move the hands and arms although the ability for movement was present. Both legs from the knees to the toes were swollen; the skin hard and tense. There were no hemorrhagic areas or old stains. The swelling was so great and so hard that the long bones could not be mapped out. Her gums were pale, not swollen

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\*Exophthalmos, due to Scorbutus.

and the 2 lower central incisors were cut. Her right eye protruded markedly and to an extent noticeable by a layman as a curious deformity, the protrusion being equal to any seen in exophthalmic goitre; the left eye was in normal relation to the orbit. The eye, eye grounds, etc., had been examined the day before I saw her by an ophthalmologist and pronounced negative.

The diagnosis of scurvy was made and, with the administration of orange juice and raw cow's milk, the baby was found sitting in her crib at the end of a week playing with toys, kicking her feet, in no pain and the eye in proper relationship to the orbit.

Owing to the paucity of both witnessed and reported cases of this condition it seems fitting that this case be brought to the attention of the profession. A tentative diagnosis would certainly occur to the pediatrician who has taken a careful history and made a careful physical examination of the child. This probably would not be the case for the ophthalmologist, who would direct his whole attention to the eye condition. The crying baby would no more impress him than any other baby firmly held for his examination and who showed discomfort through the manipulation. Such was the story in the case reported.

H. MERRIMAN STEELE.

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CASE NO. 6:\* B. W., age 10 months. Weight, 20 pounds. February 27, 1920, while playing with the stearate of zinc jar, patient poured half the contents down her throat. She immediately became cyanotic and limp. Mother tried to induce vomiting by putting finger down throat, but without any result. Child seen 10 minutes later, was cyanotic with irregular respirations and short hacking cough. Stuporous at intervals for several minutes. Attempts to induce vomiting by hot bicarbonate solution and aromatic spirits of ammonia brought up only some frothy mucus. Temperature was normal.

February 28, 1920. Temperature  $101\frac{3}{5}^{\circ}$ . Child drowsy. Hacking cough. Slight cyanosis. Diffuse fine râles over both lungs.

February 29, 1920. Temperature  $101\frac{3}{5}^{\circ}$  in A.M. Child brighter and took a little food. Fine râles both bases, more on right side. At 6 P.M. temperature  $101^{\circ}$ .

March 1, 1920. Child had a good night. Slight cough. Color

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\*Insufflation of Stearate of Zinc, with Recovery.

good. Eating well. Râles only heard at the angle of the right scapula. Temperature 99°, A.M.; 99 $\frac{4}{5}$ °, P.M.

March 2, 1920. Temperature 98°. No cough. Chest entirely clear.

The interesting features of this case were: 1. The intervals of stupor; 2. the rapid development of a diffuse capillary bronchitis; 3. the disappearance of all signs within 3 days.

NATHANIEL BARNETT.

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CONGENITAL STENOSIS OF THE PYLORUS (Rivista di Clinica Pediatrica, Florence, September, 1920). Medical treatment proved futile in the three cases reported by Squarti; necropsy in one and the operative findings in another confirmed the diagnosis of congenital hypertrophic stenosis. The operation came too late to save the two infants treated by gastroenterostomy. The first symptoms rarely appear before the second to the eighth week or even later. The explosive vomiting may occur during feeding and rarely more than an hour or two later. Pylorospasm can be differentiated by the painful vomiting and its attenuation under sedatives, the global contraction of the stomach, the occasional absence of a tumor at the pylorus, the milder course and the aspect of the stools. With the hypertrophic stenosis the stools grow less frequent and smaller, assuming the characteristics of meconium or fasting stools. The statistics as to cures under operative treatment are not dependable on account of the confusion of spastic with organic stenosis, but the lowest mortality recorded, 18 per cent. in twenty-six cases, was realized with the Rammstedt technic. With this the cylinder of muscle is slit longitudinally down to the mucosa, leaving the latter intact, and not suturing. Hypertrophic stenosis seems to be more frequent in boy babies and in the breast fed and the first born. To avoid further irritation while deciding on the preferable treatment, he advises to take the child from the breast and feed breast milk by the rectum.—*Journal A. M. A.*

## SOCIETY REPORT

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### THE NEW YORK ACADEMY OF MEDICINE. SECTION ON PEDIATRICS.

*Stated Meeting, Held November 11, 1920.*

CHARLES HENDEE SMITH, M.D., *in the Chair.*

#### FAT DETERMINATION IN FECES.

DR. ROWLAND G. FREEMAN, JR., and DR. EDGAR G. MILLER, JR., presented this paper in which they reviewed the earliest methods of fat determinations in feces, and described their method. This consisted essentially in triturating the weighed moist feces with anhydrous sodium sulphate, extracting the resultant dry powder with ether, and weighing and fractioning the ether-soluble material by the usual means. Samples (from 1 to 5 grams) of the moist material were weighed out and triturated in a mortar with 1 to 3 c.c. of concentrated hydrochloric acid; after about 5 minutes the mass was triturated with anhydrous sodium sulphate until the whole presented a dry, finely divided powder. About 35 to 46 grams of the sulphate was required for a gram of feces, although this might vary. The material was then transferred quantitatively to a well stoppered Erlenmeyer flask, a quantity of pure ether (about 50 c.c.), free from non-volatile material, was added, and the mixture shaken for several minutes. After a brief time to allow for some settling, the ether was decanted through filter paper. This extraction was repeated until no more ether-soluble material was obtained; usually 4 or 5 extractions were sufficient. The residue was then ashed with a little more ether. The combined ether extracts were then evaporated in a weighed beaker to dryness, dried at 98-100° C., desiccated, and weighed. The weight of the extracted material represented the figure commonly known as total fat. Having the "total fats," these might then be dissolved in hot benzol, and triturated while hot with decinormal alcoholic sodium hydroxide, using phenolphthalein as indicator. This gave the amount of free fatty acid. Fatty acids present as soaps might be determined by repeating the extraction on a sample which had not been treated with the

hydrochloric acid, and recording the difference between this and the result of extraction of the acidified sample. Pure beef fat and pure stearic acid were recovered by this method to the extent of 99 per cent. The chief claim for this method was its speed and its availability for ordinary clinical testing. Its accuracy, while high, was probably exceeded by some of the longer and more complicated procedures.

*Discussion*—DR. ROWLAND G. FREEMAN said the clinical examination of the feces had been difficult and in many respects unsatisfactory. One of the great values of feces examination was in children with poor digestion, children who were constipated, poorly nourished and in a generally miserable condition, and in whom it was important to find out what element in the food was not being taken care of and passed in excess in the feces. The Schmidt test affords a good method of obtaining this information so far as the proteins and carbohydrates are concerned but not for the fats. The Sudan III method has been quite generally used in the estimation of the fats, and the reports of his laboratory had stated that the fat content was so many droplets in a D field, but gave no idea of the size of the droplets or the thickness of the field, so that it was evident that a more accurate method was needed. In comparing this method with the Sudan III method, he found that the Sudan III method is absolutely unreliable and misleading: 8 fat droplets were reported in feces containing from 19 to 29 per cent. fat; 10 fat droplets in feces containing from 30 to 32 per cent. fat; 11 fat droplets in feces containing 27 per cent. fat; 12 fat droplets in feces containing from 21 to 46 per cent. fat; and 14 fat droplets in feces containing 28 to 41 per cent. fat. So whether this new method was adopted clinically or not, it seemed to prove that the Sudan III method is unreliable and not worthy of use. The test described could be carried out so as not to take more than 20 minutes to half an hour per specimen, and was sufficiently accurate for clinical purposes.

DR. GODFREY R. PISEK said they would all certainly be glad to have a new method that would throw more light on the stools of infants and children. The great trouble was to develop a method that coördinated laboratory and clinical findings. The difficulty in connection with the fats in the feces was, that when they sent a specimen to the laboratory, the laboratory and the

clinical view often did not coincide. For example, the examination of the feces might show that a large amount of fat was absorbed while clinically they had evidence that the child was not absorbing fat. We did not know today just what the significance of the fatty-acids and soaps were, hence we would be grateful for anything practical along this line that would be helpful.

DR. MILLER agreed that what Dr. Pisek had said about the coördination of clinical results with laboratory findings was extremely important, and for that reason they hoped for series of cases from various hospitals in which this method was used. Several such investigations were now under way and might throw some light upon the subject.

#### ANHYDROUS DEXTROSE IN THE FEEDING OF BOTTLE BABIES.

DR. WILLIAM H. PORTER read this paper in which he said that physiologists had long known that there was only one form in which starch or sugar could enter the circulation, and that was glucose or dextrose. For this reason and the fact that dextrose was the most soluble of all forms of sugar, the author was led to believe that pure anhydrous dextrose could be quickly and fully absorbed into the circulatory system and utilized by infants when no other form of sugar,—not excluding the maternal milk sugar—could be so utilized. For dextrose could undoubtedly be appropriated by the infant economy to produce the heat and energy necessary to innervate the digestive functions, especially during the first day or two of the child's life, when it was so difficult to get the baby's digestive apparatus into a state of functioning activity. The particular product used in this investigation was anhydrous dextrose, the anatomic construction of which was such that it was much more quickly reduced than any of the other dextrose. They believed this was still another and peculiar isomeric form of dextrose more closely approximating that particular form developed by the physiological transformation of mothers' milk in the human economy than any other isomer of glucose. The reason for believing that this was a special glucose form was further manifested in the clinical results which followed the administration of this particular glucose. The results were not comparable in any degree with those attained by giving dextrose derivatives produced by malting, or developed from grains other than corn. The product under consideration was a chem-

ically pure dextrose—a dextro-rotary sugar—furnished for these researches through the courtesy of the Corn Products Refining Company. Collaborating in the study were a number of the leading pediatricians and other specialists of New York. The combined number of cases treated by these physicians totaled well over 140. Many of the babies included in the series were institutional babies, in desperate condition, and the observations were made during the summer and fall months, during which the infant mortality reached its most alarming proportions. However, the results of these researches went to prove that the babies did quite as well, and in many cases much better, on dextrose than on any other form of sugar. In cases in which there was diarrhea and green stools, with rapid emaciation, very large doses,—2 to 4 ounces—of dextrose were tolerated. In from 12 to 24, or 48 hours at most, the diarrhea was stopped, the stools become normal, and the baby was again in a thriving condition. This sugar in small amounts did not primarily inhibit sugar growing bacteria, but, when used in larger doses, it seemed to exert the preserving properties common to all saturated sugar solutions. In this way it inhibited the development of bacterial flora which had heretofore led pediatricians to temporarily discontinue the use of sugar in infant feeding. Also by the ability of dextrose to maintain heat production, the baby's digestive apparatus was stimulated to produce more hydrochloric acid, phosphate of soda and digestive ferments quickly. These secretions were immediately brought back in full amount and quality, thus producing the normal inhibitory agents which arrest pathogenic bacteria and microbic growth in the intestinal tract. The much dreaded primary sugar fermentation was stopped, the infant returned to health. Our first heat producing food product, dextrose, had thus been turned into a powerful therapeutic agent. And if the results attained in this investigation were fully maintained, it was quite possible that 90 per cent. of the 40 per cent. of babies now condemned to die under the past régime would be saved. As a further aid in this inhibiting process, it was well to remember that the addition of a little salt would augment very materially the production of hydrochloric acid. The anhydrous dextrose slipped directly into the blood without the expenditure of any digestive energy, augmented the combustion of fat, perfected the metabolism of proteids, especially in their oxidation reduction in some of the gastric cells, and



thus stimulated the production of hydrochloric acid by nature's own method. This resulted in generally increased efficiency, and assisted in developing the digestive ferments produced by the liver, pancreas, and the various intestinal glands. With the improvement in these physiological activities, the endocrine glands performed their functions more normally. Hence a more perfect metabolism could be developed and maintained. It might also be mentioned that normal heat production was also essential to the excitation of nerve innervation—a factor which must never be lost sight of in dealing with sub-vital cases. From a summary of 103 bottle-baby cases, submitted by the Board of Health and the various pediatricians mentioned in the paper, it seemed that fully 75 per cent. demonstrated a decided gain, there being a fairly uniform increase in weight. There were no complications in the way of vomiting or green stools that could be distinctly referable to the use of this particular sugar form, and in many instances babies who failed to gain on other sugars, when put upon dextrose, immediately commenced to increase in weight. Of the cases which were unfavorable or in which there was an indeterminate result, there was no single instance coming to the knowledge of the essayist in which any other sugar substituted for dextrose resulted in improving the clinical aspects of the particular case. While the pediatric observations were under way, the author personally observed the action of the dextrose in some 35 adult cases varying from mild conditions of mal-metabolism up to cases in which death seemed inevitable. In every single instance a decided improvement was secured, many of the patients evidencing a most remarkable change for the better in metabolic and assimilative powers. In practically all of these cases, a careful study of the urine was instituted in order to determine whether any of the dextrose came over into the urine, and also the effect of the sugar upon the excretion of albumin. In not a single instance did any glucose appear in the urine. The albumin was pretty uniformly reduced, and metabolism improved in every instance, even in one case which was most desperate. In none of these patients, with the exception of 2 in whom there was a decided disturbance in the digestion, and in whom absorption was temporarily arrested, was there any glucose found in the feces. In all the severe cases these results were verified by Professor Gies. Blood sugar tests were not made because the

contention was that when the sugar tolerance had been exceeded glucose appeared in the urine. Their experience was to the effect that in anhydrous dextrose we had a therapeutic agent of proved merit, a stimulant which had won the merit of many of the leading surgeons of the world and a food product second to none in its carbohydrate value.

*Discussion*—DR. PORTER, after reading his paper, said he had one diabetic patient for the last 3 months on this sugar and taking no other medicine, and there was no increased output of glucose in the urine and none in feces and no increased blood sugar. This patient was taking 24 teaspoonfuls daily in addition to the regular diet. He had used it in pneumonia for the purpose of heat stimulation with apparent benefit and had written a paper calling attention to that fact. One military surgeon had used it intravenously in 137 cases with uniformly good results. It seemed that large quantities of this particular kind of dextrose could be used without deleterious effect and with much benefit. He had given over 400 pounds during the last few months and felt that it was a valuable addition both as a health giving food and for therapeutic purposes.

DR. HENRY KOPLIK stated that he had listened to the paper with a great deal of interest but was not quite clear as to which class of patients this form of sugar was to be supplied. Pediatricians had been at great pains scientifically to work out the underlying causes of the different forms of intestinal disturbances in infants and children so that when a child came under observation they would be able to tell what was going on with the baby and then proceed to remedy the cause of the disturbance. In other words, they had given up the idea that there was such a thing as a placebo, and from that point of view they had been working. The scientific man classified each condition in a rubric by itself or with conditions on the border line in order that he might apply certain fundamental remedies suitable to that condition. Now this form of sugar was brought forward and applied to almost everything. The fact that a baby had green movements and intestinal fermentation did not signify too much sugar unless the cause was known, and the condition could not be brought under control. After the trouble was brought under control one then applied other forms of food, and in that way tried to recover the baby, so to speak. For example, Finkelstein spent a life time in

trying to classify the intestinal disturbances of infancy. A baby might be disturbed by absolutely good food, food wholesome in every way, which in other babies was well borne, but in this baby was not well borne. A perfectly wholesome food might disagree with a baby and likewise a perfectly good sugar. Maltose, for instance, had been found very useful in some forms of intestinal disturbance but it might be objectionable in others, but the reader of the paper did not say when we should use this form of sugar and when we should exclude it. We know that in certain forms of intestinal disturbances cane sugar could be used and acted well. There was no particular thing which fitted every case. One had to classify the conditions. One had to ask himself what was going on in this particular baby, whether the disturbance was due to sugar, or to fat or to protein, and whether the baby was getting too much sugar or too much fat or too much protein. It was true that certain forms of sugar were absorbed much more readily than others. For instance, as Liebig pointed out, malt sugar was easily absorbed and well borne, and we had a form of feeding, malt soup feeding, containing a very large percentage of maltose. In other words, Dr. Koplik said he would like to know more definitely in which class of infants this sugar should be used as an almost exclusive article of food in these very sick babies; this had not been pointed out this evening.

DR. GODFREY R. PISEK expressed the hope that he would always be broad-minded enough to receive any new therapeutic or dietetic product presented for trial; one could not afford to do less than that and be scientific. One must, however, also take the opposite stand and in these cases be prepared to be very conservative in his opinion and not allow any over-enthusiasm in regard to any type of preparation to sway him. When this type of sugar was presented to him, he thought that it might possibly fit into a niche, since other forms of sugar had been found suitable to a particular condition, and if this was true we should like to know it. It was presented at a time just before the summer months when it was impossible to give it a fair trial in even a limited number of cases. At that time he stated that he would not be ready to go on record until this preparation had been tried by others not only in this city but in other parts of the country. If one thought of a product of this sort in that light he would not go far astray. He had worked with it and had given it a trial.

Dr. Porter did not state and did not mean that he had discovered a panacea. He had just presented it in this way in order that a greater number might know something about it.

DR. MARSHALL C. PEASE said he hoped he had misunderstood the speaker, but he had the impression that he had said that this was a type of sugar in which bacteria would not grow and particularly putrefactive organisms. He happened to know that bacteria would grow in any sugar that would be digested in the animal digestive tract, and that they grew most profusely in maltose and dextrose; and that they would grow though only a small amount of protein was present. But one strange fact was that they produced only a small amount of toxin in the presence of large amounts of sugar. The condition under which they produced toxin was slow growth in protein media and one having a slightly alkaline reaction, preferably 0.5 to 1 per cent. On the other hand, if they grew in a sugar medium of any type after a short time there was an increase in the amount of acid, and as the acid increased one found smaller and smaller numbers of bacteria. The bacteria either died or were transferred into spore forms. While this process was going on, the bacteria were not producing much toxin. If the reader of the paper thought he had a sugar in which bacteria would not grow he was doomed to disappointment; the only fortunate thing was they would not produce a great deal of toxin under those conditions. It is not wise to attempt to prove too much, for such efforts only serve to hinder the introduction of a product to the profession; and thus prevents the use of a food or drug which has certain valuable properties for the treatment of the sick.

DR. ROGER H. DENNETT said that since his name had appeared as concerned in this investigation he felt called upon to say a word in discussion. As he understood it, certain amounts of this new sugar had been distributed among various hospitals, and at his summer service they had received their quota. He believed all pediatricists were supposed to receive a certain share. For 3 or 4 years he had been rather enthusiastic about the theory of monosaccharides. It always seemed to him theoretically that monosaccharides, used in a certain type of baby not having good tolerance for sugar, was a rational procedure, for the monosaccharides were easily absorbed and absorbed high up in the digestive tract. Thus it might be that they could be used

without the bad influence that took place when sugars were absorbed lower down in the intestinal canal. Consequently he was very glad to try out this new sugar in a limited way this summer. In the very small number of cases in which he had used it he could draw no definite conclusions. It seemed to him that it would have to be used very extensively by a large number of observers before any very definite conclusions could be drawn by anybody.

DR. SMITH said he thought the patient who tolerated 10 ounces of glucose showed a very high tolerance. He understood that 150 to 200 grams of glucose was a very fair measure of a child's tolerance, and a patient who could take 250 grams had an increased sugar tolerance. This might be due to dyspituitarism. It had been found that pituitary cases could take as high as 300 grams of glucose.

DR. PORTER, in closing the discussion, said he did not wish to convey the idea that this particular glucose was a panacea for all kinds of disease. The fact he had tried to establish when he started out in this research work was to find out whether one could use large quantities of glucose and not have it lost in the feces, and also they had tried to find out how much the individual could tolerate without producing glycosuria. During the last 4 months, he had given over 400 pounds, and some of the patients to whom this sugar was given were in desperate condition with cardiovascular disease and with albumin in the urine. One patient whom he thought would not live 2 weeks had dropsy extending up to the shoulder blades and dyspnea and severe pain over the heart. After taking the glucose without any other change in medication and diet the patient showed decided improvement. In 3 or 4 weeks the dropsy disappeared and she was able to go away to the country. The albumin had dropped 75 per cent. At one time during the treatment the supply of glucose failed for 3 to 4 days (this was early in these investigations when the supply of the preparation was limited) and the albumin immediately increased. As soon as some more glucose was obtained and taken again, the albumin at once decreased, dropping again 75 per cent. He had seen that happen in a large number of cases. The point he wished to bring out in this study was that glucose in the absolutely pure state could be given in large doses without producing loss of sugar in the feces or pro-

ducing glycosuria and without exceeding the blood tolerance. It was not a panacea, but it would slip directly into the blood and produce the same effect that all glucose did—increase heat production, and one could obtain heat and dynamic energy from it easily and more quickly than out of anything else except alcohol. In relation to the bacteria; Dr. Gies remarked that housewives in general knew that sugar had a preservative action and that this was due to its special action in connection with bacteria. When one approached a saturated solution of glucose the bacteria did not like it and stopped acting or disappeared; whereas it was a well known fact that weak glucose solution enhanced the activity of certain kinds of microbic life.

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CELIAC INFANTILISM (Lancet, Oct. 30, 1920). The evidence presented by Miller and others suggests, that during the stages of fatty diarrhea in celiac cases bile salts may cause an improvement in fat absorption; while in the quiescent stages, when the stools are comparatively normal, their action is much slighter. On the further question as to whether the fatty diarrhea of celiac disease may be attributed to a failure in the secretion of bile salts, many more observations are evidently required before this opinion could be proved correct. In one case examined it was not possible to detect the presence of cholalic acid in the feces before bile salts were given; but the clinical effects of the use of bile salts were certainly not sufficiently striking or complete to prove this view, which Miller thinks will ultimately be found to be correct. It is possible that the excessively fatty contents of the intestine may set up a transient catarrhal enteritis, which itself may limit further the absorption of fat. Over this, bile salts would have no immediate effect. A case is reported in which at the age of 7 years rickety changes occurred in the long bones, a condition not previously recorded in connection with celiac infantilism. In every case the figures obtained were considerably heightened when bile salts were being given. In the case of the higher figures the test no longer gave quite such clear cut results as in the lower range of figures. The authors were not able to reproduce the alteration in the diastase number by adding a trace of bile salts artificially to a urine whose urinary diastase number was known.—*Journal A. M. A.*

# ARCHIVES OF PEDIATRICS

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## ORIGINAL COMMUNICATIONS

### DERMATOSES OF THE NEW-BORN AND INFANTS\*

By MOSES SCHOLTZ, M.D.,

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Theoretically, the new-born and infants may be subject to all the skin diseases of the grown-ups with the exception of senile atrophy. In practice, however, skin diseases most prevalent in the new-born and infants present a distinct and well defined clinical problem. The number of dermatoses in infancy is much smaller. They are easier of identification and are much more responsive to therapeutic control.

The justification for the isolation of dermatoses of infancy

\*Read before the Obstetrical and Pediatric Society of Los Angeles, March 9, 1920.

into a distinct clinical group can be readily found through comparing factors controlling the clinical behavior of dermatoses, as they are seen in the grown-ups and in the infants. These factors are: etiology and pathogenesis; inherent differences of the skin texture in the infants and in adults; and the differences in the susceptibility to the clinical and therapeutic control.

Etiologic and pathogenetic factors are much less numerous and much simpler in infants than in grown-ups. In infancy, they are essentially reduced to developmental and hereditary skin defects, to local and systemic infections, to dietetic and toxic rashes, and to rashes due to external irritants.

The inherent difference in the skin texture of an infant and that of an adult consists in a much greater tenderness, vulnerability and sensitiveness of the former. It largely accounts for clinical characteristics of infantile dermatoses. Infantile skin has a tendency to show exaggerated, acute and violent reactions to the mildest irritants, both systemic and local.

In regard to the clinical and therapeutic control, youth is both an asset and a liability. Since the infantile diet consists of a very few constant and easily identified ingredients, dietetic control in infantile dermatoses is much easier to enforce than in adults. On the other hand, the infantile incapacity of self control and the impossibility of reasoning with the little patients renders the problem of the control of itching much harder, and considerably retards the progress through a constant aggravation induced by scratching.

Moreover, the restlessness and the incapacity of an infant to hold still even for a short time, unless in sleep, commonly precludes in these cases the use of our best therapeutic weapons for the control of itching and the absorption of the chronic skin infiltrates—x-ray and ultra violet light.

In regard to local medication, it is important to know that the infantile skin tolerates badly all local stimulant applications, such as mercurials, tar, sulphur, etc. In acute inflammatory conditions, these drugs should not be used at all; in subacute and chronic conditions, they should be started cautiously from a very small percentage.

After these general considerations, we shall briefly review the most important and common dermatoses occurring in infancy.



These clinical forms can be conveniently grouped according to their etiology. Thus we consider: First Group. Dermatoses due to developmental and hereditary defects—sclerema, ichthyosis and epidermolysis bullosa. Second Group. Dermatoses due to infection, hereditary or acquired. Systemic—syphilis, pemphigus; local—streptococci and staphylococci, scabies, tinea, seborrhea, etc. Third Group. Dietetic dermatoses—eczemas, urticarias, seborrheas and toxic, drug rashes, etc.

*Sclerema and Edema of the New-Born.*—Sclerema of the new-born is a very rare, distressing and practically incurable condition, pathologically closely allied to scleroderma of the adults. Clinically, it is manifested by a peculiar, progressive tense edema or induration of the skin, yellowish, dusky or livid in color, starting from the lower limbs and gradually involving the whole body. Similar in many respects, edema of the new-born is an equally rare and intractable condition. It is characterized by tense edema, pitting on pressure, progressively involving the whole body. The treatment of both conditions is purely symptomatic, as the etiology is unknown.

*Ichthyosis* is a much more common congenital dermatosis with a distinct hereditary tendency. It greatly differs in the degrees of intensity, and in milder grades is often overlooked. Ichthyosis and other similar keratotic conditions have quite often for an underlying base thyroid insufficiency, and are benefited by the administration of thyroid.

*Epidermolysis Bullosa* is a congenital vulnerability of the skin sufficiently rare to merit mere mention. Clinically it is manifested by the formation of bullae on the sites of the slightest mechanical or traumatic irritation. The condition is beyond therapeutic control.

*Congenital Syphilis* is easily the most important of the diseases affecting the viability and the future physical development of the new-born. Skin manifestations are of very great value in early diagnosis of congenital syphilis. After the enlarged liver and the enlarged spleen, skin lesions are the most frequent symptom and occur in at least 50 per cent. of luetic cases. Their diagnostic value is particularly demonstrated in cases where the Wassermann or leutin test are negative. Of the 2, the leutin test proved to be more sensitive and of greater value in congenital syphilis than

the Wassermann. However, the established principles of comparative valuation of serologic and clinical evidence hold good in hereditary syphilis as well as in the acquired. A positive Wassermann or leutin test is conclusive and means specific infection, but negative tests, particularly a negative Wassermann can be disregarded in the presence of a positive clinical evidence, and the patient should be given the benefits of the specific treatment.

In severe and well developed cases of congenital syphilis, skin symptoms are so characteristic and marked as to present no difficulties of recognition. Who will hesitate to make a diagnosis of congenital syphilis in the presence of severe malnutrition, wrinkled facies, fissures and mucous patches around the mouth and genitals, snuffles, large bullae on the palms and soles, etc.? It is the middle-grade and mild cases with only partially developed symptoms that escape recognition. To avoid commonly made errors in this regard, a few points should be emphasized. Do not expect to find malnutrition and senile looks in every case of congenital syphilis. A surprisingly large number of syphilitic infants present a fairly good nutrition, in fact, at times a blooming appearance with clinically undisputable specific lesions. It is well to remember the specific morphologic characteristics which can be found in practically every case of congenital, as well as of acquired syphilis. They are: dusky red, raw ham color, sharply defined borders, deep cutaneous infiltration, but of much softer consistence and often of smoother surface, than that of psoriatic or eczematous patches.

Among syphilitic lesions of secondary period, particularly misleading in appearance, should be mentioned maculo-papular areas and patches. They are often confused with ordinary intertrigos and eczemas, especially if they are situated in the genitocrural region. The differential diagnosis can be readily made if the above mentioned specific signs are kept in mind. In contradistinction to the specific type, ordinary intertrigo and eczema always show well-defined borders, angry red or pink color, and a tendency toward exudation or desquamation. Should syphilitic patches and areas of this character be macerated and denuded, they invariably turn into mucous patches or flat condylomata.

Syphilitic bullae which, unfortunately, are often miscalled syphilitic pemphigus, always indicate grave infection. They are

preferentially located symmetrically on the soles and palms, and this selective distribution alone is a strong differential point from bullous impetigo, pemphigus or bullous erythema multiforme. Hutchinson's triad of interstitial keratitis, deafness and notched teeth is largely a manifestation of late hereditary syphilis and is not available in syphilis.

*Streptoderma*.—Another parasitic condition, involving the skin, both as a local infection, or as a part of the general systemic involvement, is streptoderma or streptococcus infection of the skin. Streptoderma is not sufficiently appreciated by the profession, neither as to its extreme prevalence nor as to its clinical importance. Streptoderma comprises a great variety of clinical types widely different in clinical appearance. This renders streptodermias difficult of recognition.

The clinical form of streptodermias, best known to the general profession—impetigo contagiosa—constitutes only a very small minority of the total number of the cases of streptoinfection of the skin. Streptodermias, not as well known, but very common in infants, occur, as persistent cracks, fissures and intertrigo-like patches in the different parts of the body, such as retro- and infra-auricular, in the corner of the mouth and in the nasal-labial fold. Here also belong single or multiple eczematous-looking patches, preferentially located on the face, neck and limbs. All these lesions, while differing widely in clinical appearance, have certain morphologic features which strongly point to their streptococcic nature and secure a clinical diagnosis. These features are: sharply defined borders, tendency to form serpiginous or gyrate figures, dark red, almost purplish color, but not dusky red, raw ham color of syphilis and not angry red or pink red of eczema. Equally typical is the tendency to crusting, as the dominant clinical characteristic of streptococci on the skin is to produce serous exudation, drying up into crusts either in the form of bullae or blebs, as in impetigo contagiosa and pemphigus, or diffusely on the open surface, as in the just open types. It is also characteristic for streptodermic patches to be of much softer consistence and of much softer and smoother feel than the patches of ordinary chronic eczema.

As to the bullous forms of streptoderma, the consensus of opinion at the present time is that so-called pemphigus is nothing

but a grave and systemic form of impetigo. It seems extremely likely that many, if not all, cases of infantile pemphigus take origin from some of these unrecognized and misinterpreted lesions.

Staphylococci are present in all these lesions, as secondary invaders. Purely staphylococci infection is manifested by furunculosis and by follicular impetigo.

So-called exfoliating epidemic dermatitis of the new-born, described by Ritter, is not a well established and identified clinical entity. Some of them seem to belong to toxic inflammatory dermatoses, others, to the infective types, such as pemphigus.

*Eczema* is one of the most common and most annoying dermatosis of infancy. As to the pathogenesis, it may be primary, due to local or systemic irritants, or it may be secondary, as a complication to some primary underlying condition, such as seborrhea, streptodermia, scabies, tinea, etc. Among primary eczemas, dietetic infantile eczema is the most important. In early infancy, it is mostly due to the excess and to the faulty digestion of fats or carbohydrates; in older children, to proteids.

The so-frequently reported stubbornness of the infantile dietetic eczema, in spite of all possible dietetic regulations and restrictions, is due in most cases to the inadequate attention or to the complete ignoring on the part of the attending physician of the local treatment. The mere fact that dietetic eczema is so often limited to certain localized areas, such as the face, neck and limbs, shows that the local factor is of importance. A fundamental fact of the skin pathology, so commonly overlooked by the internist, is that even in purely systemic dermatoses, skin lesions, once formed, evolve a secondary chain of local pathologic changes, such as infiltration, lichenification, infection with streptococci, staphylococci or seborrheic contagium. These secondary changes are entirely independent of the original etiologic systemic factor and they respond to the local treatment. Add to it a constant aggravating effect of scratching, due to the intolerable itching, and of all sorts of external irritants, to which the skin is subject, and the importance and necessity of the local treatment in systemic eczema will be self-evident.

*Secondary Eczemas.*—The recognition whether eczema is primary or secondary is, of course, of paramount importance because in secondary eczemas the underlying primary condition

is to be treated first, after which the eczema is cleared up without difficulties. Secondary eczemas are usually local and are largely due to parasitic conditions, such as seborrhea, scabies, pediculosis or strepto- or staphylococci infection. These types of secondary eczemas are easily identified by the presence of the special clinical features which are typical of the primary underlying condition and which are never observed in common uncomplicated eczemas.

Thus seborrheic eczema is readily recognized by heavy yellowish seborrheic scales, by the lack of infiltration in spite of a chronic duration and by a characteristic distribution from the top of the scalp downward over the hairline.

Eczema, due to scabies, will betray itself by discrete, scattered widely apart patches in locations typical of scabies, such as flexor surfaces, nipples, abdomen, genitals, web of the fingers, etc.

Eczema due to *tinea tonsurans* can be recognized by sharply defined borders, round or circinate shape, rather superficial infiltration and tendency to spread in the periphery.

Eczema due to streptococci infection or so-called impetiginous eczema is really a patchy inflammatory type of streptoderma described above. The correct interpretation of eczematous-looking patches can be readily effected by a careful and systematic differential analysis of the clinical features.

*Urticaria* is very common in infancy. It can be brought on, both by systemic toxins, and by external irritants, such as insect bites, plants, etc. Clinically, urticaria in infants resembles in appearance and runs the same course as in adults, with 2 exceptions. One is a tendency to form papular lesions. These papules, lichen urticatus of the old writers, of inflammatory nature usually develop at the site of regular wheals after their disappearance and they can be identified as being of urticarial origin only in conjunction with the whole cycle of their clinical evolution. The other characteristic tendency of infantile urticaria is to form persistent lesions with pigmented deposits and cellular infiltrates, so-called urticaria pigmentosa. Urticaria pigmentosa is characterized clinically by salmon yellow, bluish and purplish stains which, on rubbing, flare up as regular wheals, betraying their urticarial nature. The treatment of urticaria pigmentosa is unsatisfactory. Luckily it has a tendency to subside with the approach of puberty.

*Drug rashes* are quite frequent in infancy. Drug rashes in

infancy retain their general characteristics observed in adults; they develop suddenly, often in crops; they are very freakish in type and distribution. They commonly disappear on the discontinuance of the suspected drug. The usual types of drug rashes in infants are diffuse erythemata, urticarias, bullous, vesicular and fungoid. The drugs most frequently producing rashes in infants are: belladonna, antipyrin, quinine, iodine, bromides and immunizing serums. It is important to remember that iodine and bromides possess accumulative properties. Because of it, iodine and bromide rashes do not clear up immediately after the discontinuance of the drug, but persist and even may give fresh outbreaks, misleading an unwary one into a false diagnosis.

*Postvaccinal Eruptions.*—The considerations of infantile dermatoses would not be complete without mentioning postvaccinal eruptions. Postvaccinal eruptions can be conveniently grouped into 2 classes. The first is due to the accidental infection. Most common of this class are: impetigo, furunculosis, erysipelas and pemphigus; less common, syphilis and tuberculosis.

The second group is due to the vaccine virus itself, as a result of anaphylactic reaction. This reaction may show itself locally by erythema, dermatitis or by a local vaccinia; in the case of a systemic reaction one may get generalized scarlatinoid rash, erythema multiforme, urticaria and general vaccinia. Many of the cases of eczemas, psoriasis, pemphigus, etc., allegedly developing after vaccination, are merely in accidental chronologic, and not in a casual, relationship with vaccination.

#### CONCLUSION

This concludes a brief consideration of the most common dermatoses of infancy. While retaining the essential clinical characteristics seen in adults, they present sufficient peculiarities in diagnosis, clinical behavior and treatment to justify their consideration, as a distinct clinical problem. Skin lesions in infancy are very common and manifold, and their clinical importance fully merits a closer and a more detailed acquaintance on the part of pediatrician and obstetrician.

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## DIABETES IN CHILDREN

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The form of diabetes that usually occurs in children is the form where the pancreas is primarily affected, and is an organic condition. (For a classification of the various forms of diabetes, anyone interested is referred to an article, "Diabetes," Boston Medical and Surgical Journal, Oct. 2, 1919.) The cause is usually due to an infection of the pancreas and the infecting germ frequently enters through the tonsils. It may occur at any age, although personally I have never seen a case occurring in a child under 10 months of age. The onset is sudden; in fact, the excessive thirst and polyuria may be definitely noted to have begun within an interval of 24 hours, and on careful inquiry it will frequently be learned that the child had some infection affecting the tonsil within at least a month (usually within a week) of the commencement of the thirst. Following this there is increased appetite and progressive, and at times, great loss of weight. (I once saw a boy, aged 11 years, in whom the weight dropped from 117 pounds to 86 pounds within 4 weeks, after the polyuria and thirst were first noticed.) There is increased appetite, and the skin is dry and harsh. The tongue is dry and in some cases brown. In many of these cases there is a "sore spot" discovered on deep pressure over the region of the pancreas.

The urinary findings are characteristic: large amounts of normal-appearing urine; specific gravity from 1020 to 1045; very slight trace of albumen, many times none at all; a large amount of sugar, from 20 to 500 grams, depending on the age of the patient and the virulence of the attack; considerable to very large amounts of acetone, and frequently diacetic acid.

If, as sometimes happens, there is an accompanying infectious nephritis, there may be small amounts of albumen and some hyaline and granular casts. I have never seen anything approaching an acute nephritis with blood, tubule cells, etc.

The diagnosis is easy, but the proper line of treatment much harder to decide upon.

Each case, to get the best results, must be considered by itself, and our first care is to decide whether the case is one where the

liver fails to functionate properly (the hepatic form) or where the pancreas is organically affected (the usual form in children).

As the hepatic form rarely occurs in children, and when it does occur, is usually due to a diet greatly overloaded with sweets and a liver function unable to cope successfully with this great overload, it is obvious that the removal of the excess of carbohydrates will cause the urine to become sugar-free. When this is accomplished (which should take only a few days), the diet must be held at this carbohydrate level for a considerable length of time. In this way, the carbohydrate tolerance can be slowly increased, and in time the diet can be cautiously and slowly added to.

In cases of this form occurring in children, it is always well to remember that they have a carbohydrate tolerance below normal, and it must not be over-taxed; otherwise, if this occurs, the tolerance is temporarily, at least, again lowered. Therefore, it is better to err on the safe side in restricting the carbohydrate tolerance as the longer these cases go without any sugar reappearing in the urine, and the child develops normally, the better the carbohydrate tolerance becomes. This form of diabetes is of such rare occurrence in children, and is so easily treated, that I will dismiss it with these few words, and take up the consideration of the form (pancreatic), which is much more common in children, and in which the treatment is much more difficult.

In the pancreatic form, we must take into consideration the various symptoms, the apparent rapid or slow progress of the case, and how long it has been since the first symptom appeared; also the patient's likes and dislikes for certain articles of food, before deciding on the primary diet. Where the attack is of recent origin and is progressing steadily, where there is considerable loss of weight, in other words, where the process in the pancreas as indicated by the symptoms shows a steady, rapid progress, we must limit the diet, especially as regards carbohydrates, very decidedly. While on the other hand, where the child has had the symptoms of the disease for a longer time (weeks or months), without any apparent serious harm to his general health, and there has not been much loss of weight, and perhaps the urine has been sugar-free at times on a partially restricted diet, in these cases it will not be necessary to restrict our primary diet so rigidly as regards carbohydrates.



A very good specimen diet in the latter class of cases, for a boy aged 10 years, would be, for breakfast, half a small orange, a Lister muffin with a little butter, a dropped egg, and a little milk consisting mostly of top of bottle. For dinner, about 8 ounces of thin meat soup, a Lister muffin with butter, a little celery, lettuce, asparagus, or swiss chard, and the same for supper, with the addition of a few olives.

After watching the effect of this diet for a few days, we can then cautiously begin to add to or subtract from it as the patient's symptoms and urinary and blood sugar findings indicate. When the patient becomes sugar-free, and the blood sugar approaches normal, the diet can be added to, slowly and cautiously, consulting as far as possible the patient's individual likes and dislikes rather than strictly adhering to the 5 per cent. and 10 per cent. list of vegetables, as my experience has been and my experimental work has proved that one patient may be able to take twice as much carbohydrate in one form of vegetable without showing sugar, where half that amount in some other form may cause sugar to appear in the urine. Many children can take considerable amounts of milk raw and cooked without causing sugar to appear in the urine.

Children have a great craving for something sweet, and it helps very materially to keep them contented with their diet if we can give them something sweet, such as a custard or ice cream sweetened with saccharin. I have never seen any harmful effects in children (or, as far as that goes, in anyone) from the use of saccharin, and when correctly used it provides a means for us to satisfy the intense craving for something sweet, and makes the child more contented to remain on the prescribed diet.

In the case of children, as a rule, it is harder to keep them on a restricted diet than it is in the case of an adult, but I find that by studying the likes and dislikes of each individual case, and building the diet as far as possible to conform to these likes, and by furnishing saccharin-sweetened desserts, it is much easier to keep the child on a properly restricted diet.

Before leaving the question of primary diets in this class of cases (pancreatic), I want to emphasize one point: In the cases where the onset has been very sudden and recent, where the output of sugar is much larger than would correspond with the intake

of carbohydrates, where there is a constant and rapid loss of weight and large amounts of acetone or diacetic acid in the urine, in other words, where the pancreas is very profoundly affected, do not put these cases on a so-called "starvation" diet. My experience has been that this step will hasten the coma and death, which might be postponed for a time by the suitable and judicious allowance of a certain amount of carbohydrate to the diet.

It is very important to have the throat, and especially the tonsils, examined by a competent man, and where any abnormality is found, to have the tonsils removed (not cut off).<sup>\*</sup> If this is not done, it may happen that after the urine has been sugar-free and the patient seems to be progressing favorably, some day an infection shows in the tonsils and the blood sugar increases, likewise the urine sugar, although the patient may be taking much less carbohydrate than before the tonsil infection occurred. Following each of these exacerbations, we will usually find that the patient's carbohydrate tolerance is permanently lowered until it becomes impossible to stop the progress of the destructive condition in the pancreas, and coma comes on and is followed by death.

*Prognosis.* This depends on how much tolerance the patient has, and his previous health. In a case where the output of sugar in the urine is more during each 24 hours than would correspond with the intake of carbohydrate, and where it is very hard or impossible to get the urine sugar-free, in this class of cases the prognosis is very poor. Where, on the other hand, the urine can be easily made sugar-free, and the patient shows a tendency to increase in weight as he develops, and especially if, as time goes on, we find the tolerance increases, the prognosis is fair as far as life is concerned, but I do not believe that any case of the pancreatic form of diabetes so far recovers as to be able to eat a diet rich in carbohydrates without ultimately (in a few months at most) having sugar reappear in the urine.

Now for a few don'ts effective in cases of the pancreatic form. Don't feel confident, because for 6 months no sugar has appeared in the urine, that the child is well, and tell the parents that the child can eat anything. Be very cautious in markedly increasing the carbohydrate content of the food, as long as the child is developing properly. Don't prescribe thrice boiled vegetables and

<sup>\*</sup>Blodgett, S. H.: Diabetes, Pancreatic, Caused by Infection of the Tonsils (to be published in Penn. Med. Jour., March, 1921).

expect that the ordinary child will eat them for more than a few days at most. Besides this, in a case where the child cannot eat ordinarily cooked spinach without causing sugar to appear in the urine, the prognosis is bad anyway, and thrice boiling the spinach will not improve it any, but will only add to the child's suffering, the short time it can live. Don't think you have given the child a proper final diet, even if the urine is sugar-free, unless he also gains in weight and develops physically, although perhaps slowly. Don't feel perfectly satisfied that you have done everything possible for your little patient when you have prescribed a diet containing 50.1 calories per milligram body weight. Remember that we are told 945.2 c.c. of gasoline should be sufficient to run a Ford car 5 miles, but if you trust implicitly to "should be," you may have to walk. Don't forget that many children on a strict diet are sorely tempted to take some forbidden food on the sly (usually a "sweet"). Think of this if sugar unaccountably appears in the urine, and after getting it sugar-free again, try by the use of saccharin in food to forestall the child's intense craving for "something sweet." Don't neglect to consider each case individually, especially as regards the final diet, and don't neglect to use some common sense along with your scientific knowledge.

520 Beacon Street.

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EPINEPHRIN IN TREATMENT OF PNEUMONIA IN INFANTS (Archiv für Kinderheilkunde, Stuttgart, Oct. 16, 1920). J. Vogl injected subcutaneously 0.2 c.c. of a 1:1,000 solution of epinephrin in sixty infants with pneumonia or capillary bronchitis in the Prague foundlings' asylum and in thirty brought to the dispensary. From one to four to eight injections were made daily, seeking to utilize the vasoconstricting and inflammation checking action of the epinephrin. The death rate was 6 per cent. in the institution and 13.5 per cent. in those brought from outside for the injections. The mortality in the outside cases not treated with the epinephrin was 45 per cent. He emphasizes that bringing the pneumonia infants to the dispensary was a kind of fresh-air treatment which had a salutary effect. Eight days was the longest epinephrin course in any instance. He regards it as an actual causal treatment, combating the process of exudation in the finer air passages and infiltration of the lung tissue.—*Journal A. M. A.*

## STATISTICS ON THE VON PIRQUET REACTION

By J. CLAXTON GITTINGS, M.D. AND JOHN D. DONNELLY, M.D.

Philadelphia

Although an enormous mass of statistics on the results obtained with the von Pirquet tuberculin test has been accumulated, additional data based upon findings at autopsy are always desirable, particularly in view of the increasing use of protein sensitization tests and the possible relation that the tuberculin test bears to them.

The figures to be reported were collected from the records of the Children's Hospital, Philadelphia, for the past 10 years. The technique employed was the regulation denudation with the von Pirquet borer and immediate application of one drop of pure tuberculin (O. T.). For the past 6 or 7 years, a drop of the glycerine supplied by the manufacturers of the tuberculin has been applied to the control area. Reactions have been determined by the appearances 24 and 48 hours after the application.

*Autopsies.* Twenty-seven patients were found to be tuberculous at autopsy. Of these, 16 had given positive von Pirquet reactions and in 11, the test was negative. Among the latter, however, the test had been repeated in only one instance.

The results may be tabulated as follows:

Type of case	Number	Positive von Pirquet	Negative von Pirquet
Pulmonary .....	9	4	5
Generalized tuberculosis with meningitis .....	9	7	2
Generalized tuberculosis with- out meningitis .....	8	5	3
Osseous tuberculosis .....	1	0	1

Apart from the fact that only one re-test was done in 10 of the 11 non-reacting cases, the high percentage of negative results must have been dependent in large part upon the stage of the disease at the time the test was made. Of the 11 negative results, 8 were obtained in children who died within 2 weeks.

Another patient, not included in the 27, gave a positive von Pirquet reaction and was diagnosed as pulmonary tuberculosis ante-mortem but no lesions of tuberculosis were demonstrated at

autopsy. This result, however, cannot be accepted as an authentic instance of lack of specificity of the tuberculin reaction. The autopsy was done by one of the residents, presumably during an emergency, histological examinations were not made nor were guinea pigs inoculated.

*General Results.* The figures giving the total number of tests at different ages may also be presented:

Age	Number of Cases	Number of Tests	Percentage of Positive Reactions
Under 1 yr.	434	541	15
1 - 2 yr.	304	359	22.33
2 - 4 yr.	214	240	24.75
4 - 6 yr.	107	119	30.8
6 - 8 yr.	74	82	42.
8 - 10 yr.	52	54	32.67
10 - 12 yr.	29	36	31.
12 - 13 yr.	5	6	80.
Total	1219	1437	

As a rule the test was made on suspicious cases only, and the results correspond quite closely to those of Veeder and Johnson.\*

*Repetition of the Test.* One hundred and fifty-eight children were tested twice with negative results, 15 were tested 3 times with negative results, and only 12 showed a positive result on the 2nd test. In other words, of the 185 children re-tested, 6.5 per cent. were tuberculin sensitive only on the 2nd test.

Hamburger contends that the intracutaneous method is from 25 per cent. to 30 per cent. more delicate than the cutaneous test of von Pirquet, but in 263 negative cases which were re-tested by the intracutaneous method, Veeder and Johnson found an increase in positive reactions of only 10 per cent.

The difference in positive results, where the intracutaneous method is used in re-testing, as compared with a second von Pirquet, hardly seems great enough to compensate for the much more complicated technique of the former method. Exceptions may be made where large series of children are being tested or where reasons exist in certain cases for excluding as surely as possible the existence of a tuberculous infection.

\*Am. J. Dis. Child., 1915. IX, 478.

Bass' experience\* suggests strongly the necessity for at least a repetition of the von Pirquet test. In a children's asylum he found that 25 per cent. of those who gave a negative result at first, became positive on re-testing either by the cutaneous or intracutaneous method.

*Positive Followed by Negative Tests.* In 5 children in our series, a positive test was followed by a negative result. Four of these were seen in severely ill infants under 1 year of age suffering from acute ileocolitis, empyema and infantile atrophy (2 cases). The fifth case was a child of 12, ill with typhoid fever. Bass found a number of instances of a negative following a positive reaction after an interval of 6 months.

Our cases were re-tested within 2 or 3 weeks and the results emphasize the fact that we have much yet to learn regarding all the phenomena pertaining to tuberculin sensitiveness. The patients ill with typhoid fever, empyema and ileocolitis possibly evidenced the condition described by von Pirquet as anergy which is seen so often in measles, and, at times, in other infections. (Hamburger.)

*Diagnosis.* The comparison of clinical diagnosis with those made at autopsy always is of interest.

Diagnosis At Autopsy	Number of Cases	Clinical Diagnosis
Generalized tuberculosis with meningitis	9	Tuberculous meningitis
Generalized tuberculosis with- out meningitis	2	Generalized tuberculosis without meningitis
Generalized tuberculosis with- out meningitis	4	Pulmonary tuberculosis
Generalized tuberculosis with- out meningitis	2	Non-tuberculous bronchopneumonia
Pulmonary tuberculosis	6	Pulmonary tuberculosis
Pulmonary tuberculosis	1	Gastroenteritis
Pulmonary tuberculosis	1	Infantile atrophy
Pulmonary tuberculosis	1	Non-tuberculous bronchopneu- monia
Tuberculosis of the cervical spine	1	Poliomyelitis

\*Am. J. Dis Child., 1918, XV, 313.

On the basis of this table, certain facts may be emphasized:

(a) The clinical designation of generalized tuberculosis with meningitis depends upon the terminal meningeal infection. That the latter practically always exists as a secondary infection is, of course, well recognized but its importance justifies the choice of the diagnostic term.

(b) Generalized tuberculosis, without meningitis, usually is diagnosed as a pulmonary disease, because of the extent of the pulmonary involvement. As the tuberculin test is of clinical value only in the first year or two of life, and sputum is difficult or impossible to obtain where the involvement of the lung consists chiefly of miliary tubercles, there is some justification for error.

(c) The distinction between infantile atrophy, chronic "gastroenteritis" and non-tuberculous bronchopneumonia on the one hand, and pulmonary tuberculosis on the other, may, at times, be extremely difficult in the presence of a negative tuberculin test. Repetition of the latter, however, should reduce the percentage of error.

(d) Unless the history and course be typical of the type, the possibility of tuberculous spondylitis should always be considered in the differential diagnosis of a spinal paralysis.

*Conclusion.* This series demonstrates again the high percentage of tuberculous infection and the comparatively low incidence of recognizable clinical tuberculosis in childhood. Additional evidence is adduced to prove that a positive tuberculin reaction does not occur in the absence of tuberculous infection. There should be at least one repetition of the tuberculin test (von Pirquet), if the first proves to be negative.

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GALACTOSE METABOLISM IN INFANTS (Archiv für Kinderheilkunde, Stuttgart, Oct. 16, 1920). Selma Meyer and G. Stern report from 63 tests that the limit of tolerance for galactose after ingestion of from 10 to 60 gm. seems to be 20 and 40 gm. in infants of 1 and 2 years. Elimination of larger proportions than 0.5 and 3 gm. with these amounts is a sign of insufficiency in some part of the digestive apparatus. After subsidence of the acute phenomena, the liver will generally be found below par.—*Journal A. M. A.*

## THE PSYCHOLOGY OF THE CARDIAC AND THE DOCTOR.\*

By ROBERT H. HALSEY, M.D.

New York

Children with heart disease have varying degrees of a specific physical deviation from the normal and, frequently in addition, certain general, acquired, mental, social, educational and environmental differences. It seems to me it would be profitable to discuss with you as pediatricians, who deal with physical abnormalities, a few observations upon the behavior of some children with heart disease.

These children frequently showed a certain diffidence and lack of initiative, a disinclination to associate with others; often, too, a moderate lower grade of school knowledge and a certain eager readiness to attribute their backwardness and inefficiency to the possession of heart disease, the statement often accompanied by a significant gesture of the hand toward the left breast. It seemed to me these general deviations in behavior were derived from 3 sources: the family, friends and teachers; others with heart disease; and the family physician.

Of all the various modes of death, statistics tend to show that heart disease accounts for a very large percentage, but, while this fact is not generally known, it is rather common to find many families of which an older member can be found to relate from tradition or personal experience, the sudden death of a child or older individual. It is a popular tradition that the term "heart disease" connotes the possibility of sudden death. Mention in a gathering of people the phrase "heart disease," and notice how quickly it will activate the memory of some one to recall names of relatives, often many times removed, who were said to have died of, or been confirmed invalids because of, heart disease; more rarely the story of some one who was reputed to have had heart disease, but always seemed to have been able to do everything except when it was more convenient to cloak the preference not to work by the claim of cardiac difficulty. Many of these were seen in the recent draft examinations, and dated their heart trouble back to childhood diagnosis, or a physician's certificate.

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\*Read before the Section on Pediatrics, New York Academy of Medicine, October 8, 1920.



Unfortunately, popular tradition makes and knows no distinction in degrees or forms of the disease. Knowing the importance of the organ to the life of the individual and having heard of some persons who died suddenly, they are often so impressed, that their constant fear is that some slight infraction of a physician's directions against physical exercise will be penalized by sudden death. So all-pervading is this fear, that relatives and friends converse concerning the child with heart impairment in whispered voice accompanied by significant shrugs of the shoulders, raisings of the eye-brows, and noddings of the head. Perhaps from another patient one hears of the administration of such drugs as digitalis and strychnin, which are popularly associated with heart disease, and prescribing them has convinced the apprehensive family of the unexpressed, or thinly veiled opinion of the physician, that the patient has a seriously impaired organ. The frequent daily repetition of a dose of "cardiac tonic" carries unjustified conviction and gloom to many a household. It becomes a daily dose of introspection and depression. On rarer occasions, one finds a garrulous, flippant child, or parent, telling of a rashly-made diagnosis plainly contradicted by a subsequent physically active, athletic life. The knowledge of one such error has roused in the family a hope, which they have strengthened into a belief, that all such diagnoses are incorrect. Of course, this type is not common, but unfortunately from statistics, which I have, the possibility of such errors are far too great.

The disappointment from disability to accomplish one's desires in life because of acute exaggeration of symptoms, such as dyspnea, cervical or breast pain, cyanosis or swelling of the legs, may justifiably cause in a patient apprehension and fear for the future enjoyment and productivity of his life. These organic damages force on the individual child the necessity of a psychical adjustment to lessened physical activity at a time when the physical body is making its most rapid development. The detailed relation by one cardiac to another of symptoms, sensations, failures and fears may be the means of increasing a hopelessness, entirely unwarranted, since the name of the organic damage, while being the same, may not be of like degree, and the restraints, advised for one cardiac, often are not necessary to impose upon another.

The observations by cardiacs of the management accorded in

public schools by the teachers and scholars, often depresses by emphasizing their physical shortcomings or intellectual backwardness, which are repeatedly ascribed to the heart disease, until the patient becomes discouraged and hopeless, or, in desperation, attempts to do physical work in excess of his cardiac reserve power.

The recent private and public utterances of some physicians have impressed me because of their hopeless mental attitude toward the patient with heart disease. The physician who has had a hospital interne experience may become pessimistic about cardiac disease, for he sees only the last stages. During the war, many cases of so-called "shell shock" were made serious and severe by the ill-timed sympathy of a soft-headed physician or medical board. The same type of psychic damage can be produced in children by the expressions of pity for them by their family, and sympathy for the family by the friends who enquire as to how soon before the child is expected to die. Rarely having an opportunity to observe the much more common milder grades of heart damage, the interne becomes so imbued with the probability of early death as a reaction to their experience and environment, that they do not discriminate, and all cases, as soon as diagnosed "cardiac," seem to them doomed to the same early end.

It has seemed to me that the more one sees of heart disease in children the more hopeful he may become; for the cardiac condition of most children under proper supervision improves very rapidly, much more rapidly than one would anticipate. While the cases coming to the hospital ward are usually in the final stages, yet numerically, they are a small minority of the large number of hearts which are damaged. The greater number of damaged hearts are of a milder degree and live for the most part a natural, physical, active life. Too frequently the diagnosis depends upon the presence of a murmur and treatment consists of rest and digitalis. The accomplished act of prescribing some medicinal fluid seems to satisfy and paralyze the mental activity of the physician in advising further methods of relief. Restriction of the physical liberty follows at once without consideration of the needs of the cardiac muscle—exercise of the mind is equally abhorred. The poor victim lies for weeks or months without occupation or diversion from the continued contemplation of his handicap.

Briefly then, the cardiac child receives from parent, friend, teacher and doctor a long list of "don'ts" but no substitute "do's." The doctor, frequently, is responsible for unnecessary medicine and undue restrictions, because he does not thoroughly study the patient and his limitations, but rather treats all cardiacs as hopeless cases with the implication of imminent early death.

Since primarily the physician must instruct the family, teachers and cardiac, it seems to me we can profitably discuss the means of modifying these various mental influences which increase the introspection of the cardiac, increase his hopelessness, and retard the physical and mental development.

The child can and will adjust itself to restrictions, if it has some substitute method of occupying its physical energies, as well as satisfying its mental desires.

The cardiac child reacts to environment and is stimulated by group work to rapid development, mentally and physically.

A wholesome, cheerful mental atmosphere is created by encouraging active, useful recreation work and pursuing some vocational training suitable to the creed, race and social status of the child.

The physician can obtain better results and perform a greater service by a more careful study of the individual cardiac and the social problems involved.

Physical exercises, properly directed in games, dancing and occupations, will help to improve the cardiac muscle and the mental attitude of temperament of the child.

Gathering cardiac children in groups does not produce hypochondriacal depression but rather stimulates a rational cheerfulness. The individuals learn to discriminate and differentiate between the severity of their conditions. The individual improvements are noted, and the whole group derives encouragement.

Where there is better understanding of the reasons of the restrictions, there is better coöperation. Better coöperation means better results in a longer and more productive life.

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THE SUGAR CONTENT OF THE BLOOD IN INFANTS (*Archiv für Kinderheilkunde*, Stuttgart, Oct. 16, 1920). S. Mertz concludes from his long analysis of what has been published on this subject that the carbohydrate metabolism of infants and young children obeys the same laws as in adults. It has no special features.—*Journal A. M. A.*

## SEGREGATION OF SCHOOL CHILDREN WITH HEART DISEASE\*.

By WALTER F. BOPP, M.D.

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It has been a mooted question as to what can be accomplished by segregating children with cardiac disease in special schools. When, in the autumn of 1919, it was decided to organize a school class for our cardiacs I decided to form a control class of similar cases who were to attend the regular school and so to check up what we were really accomplishing. Unfortunately my class was limited to a total of 24 children; a like number of control cases was selected from our clinic, making the total number under observation 48. It has been my endeavor to select children with heart lesions as nearly similar as possible.

All the children received the same attention in the clinic and the same treatment; in order to have the home surroundings as nearly alike as possible cases were selected of the same nationality and the social service nurse watched the homes very carefully to check up any differences that might develop. The parents of all the cases were of very fair degree of intelligence and coöperated in every way. There were 6 nationalities represented—Hungarians, 2; Americans, 4; Irish, 6; Jewish, 12; Italians, 12; and Germans, 12. An attempt to secure a uniform food ration for all children was not successful, but a fair approach to uniformity was secured by comparing cases of the same nationality. As the Board of Education provided a teacher for the grades 4B to 6B only, I was compelled to select my cases, not according to the physical indication alone, but also according to their educational requirements; as a result I was able to muster only 23 cases of acquired heart disease who fitted into the grades established; the other place was given to a case of congenital heart disease. This in turn necessitated placing a congenital case among the controls. The time of observation was for the full school year from September, 1919, to July, 1920, a period of 10 months.

As to the etiology, in 30 cases it was directly attributable to rheumatism; in 5 cases chorea was the factor; measles accounted for 4; influenza for 3; and scarlet fever and diphtheria each for

\*Read before the Association of Cardiac Clinics at the New York Academy of Medicine, December 10, 1920.

2; the remaining 2 cases were congenital. The lesions present were grouped as follows: mitral insufficiency, 36 cases; mitral insufficiency and stenosis, 6; myocarditis, 4. It will be seen at a glance that in our series 60 per cent. of the cases are rheumatic in origin; the most frequent form of valvular involvement is a mitral insufficiency which was present in 75 per cent. of the cases. The infectious diseases account for about 20 per cent., chorea being responsible for the remainder.

All these cases had in the past been compelled to spend from 2 weeks to 3 months during every school year either in bed or in the hospital; of the 24 children in the cardiac school, 21 did not lose a single day, this being the first time in their entire school life that they were able to be continuously present. One child was in the hospital with a broken leg, another with pneumonia; in neither case was the absence due to the heart; the third case was the congenital heart case and this child had to be discharged from all school attendance due to the progression of its heart trouble. Of the control cases the congenital did badly from the start and after 6 weeks of school was compelled to leave permanently; the lesion progressed rapidly and the child died in a few months. Of the remaining controls, 6 developed such marked decompensation that they had to be admitted to the wards for an average stay of 8 weeks; one girl of 12 died after her discharge from the hospital as a result of a cerebral embolism. The other 18 had 8 children with a good attendance and no absences; the remaining 10 were frequently compelled to stay at home with slight decompensation, attacks of rheumatism and tonsilitis.

The weight chart of the children is rather interesting. All the cases were weighed at regular intervals and always stripped to avoid any possible error. Both congenital cases lost weight progressively and will be dismissed from further consideration in this paper. Of the controls, 5 showed an average loss of 7 pounds for the year; the other 19 gained an average of 2 pounds. In the cardiac school, every child gained weight, the average increase being 9 pounds, a most decided advantage for the segregated school children.

It has been repeatedly affirmed that segregation of cardiac children tended to depress them and engender the introspection habit in them. I must admit that I myself doubted the wisdom of sep-

arating these children from their more fortunate comrades, but I found myself mistaken. Those children who attended the regular school, and, by reason of their disease, were unable to take part in the ordinary games of their well playmates were unduly sensitive and very conscious of their physical inferiority; this applies more to the boys than to the girls. On the other hand, the children who attended the cardiac school were, with one exception, contented and happy; they all seemed to like their surroundings and to enjoy the games provided for their amusement. Part of this atmosphere of contentment was unquestionably due to the personality of their teacher who took an intense interest in the work and established a feeling of comradeship between teacher and pupil that was remarkable.

As to the heart condition itself, our observation showed the following results: all the cases of myocarditis, both in the school and the controls, did very well, the average degree of improvement being about 90 per cent. Of the 6 cases of mitral insufficiency and stenosis, the 3 attending the cardiac school showed a moderate degree of improvement the compensation established being fairly stable; those in the control class all developed severe decompensation and had to be admitted to the wards, one of the cases dying. Of the 18 cases of mitral insufficiency in the cardiac school, all did well, the average degree of improvement being about 70 per cent.; compensation was established in all and maintained; the heart action improved steadily, the force of the pulse, rhythm and quality all showed progressive improvement. Of the controls, 10 had some more or less severe signs of decompensation during the year, although not so bad as to necessitate hospital care; rest in bed at home with the needful medication always brought them around again; in several, acute attacks of rheumatism developed; in one, a slight attack of chorea occurred. All these children lost from 2 to 6 weeks of school. The remaining controls, 8 in number, passed through the school year without any trouble and remained fully compensated although their improvement was by no means as marked as it was in the cardiac school children.

Of course, the cardiac children had certain advantages which the controls of necessity lacked. The cases of insufficiency and stenosis were transported to and from school by the department

bus while the controls were compelled to walk; as the school building was provided with an elevator, all stair climbing was obviated. Again, none of the cardiac school children were allowed to go home to lunch at the noon hour, but received their meal at the school, the diet being selected by us. The rest period during the noon hour was of the greatest benefit and all the children quickly learned to look forward to it as they soon realized the resulting benefits. Most of them slept through the period, cots and blankets having been provided.

An additional and very important help was furnished by the playground on the roof of the school where these youngsters were kept from 3 to 5 o'clock. This made it possible to control their activities while at play and to limit the amount of exercise taken according to the needs of the individual case. One thing however, is of primary importance if such playground activity is to be successful: the children must feel that they are really at liberty to play; the moment the child begins to realize that the games, etc., are not of its own choosing, interest flags. The teacher must have the ability to enter heart and soul into the various games, and so to speak, be a child with the children, yet be on guard continually for any evidence of overactivity and insist on frequent rest periods.

The control cases were, of course, instructed as to what games to avoid but, being children, promptly disregarded all warnings and tried to keep up with other children in playing the usual childhood games. The girls appeared to be more amenable to reason than the boys, but both sexes were inclined to overdo things without supervision.

Taking all things into consideration, the following conclusions appear fully justified; the segregated cases attended school without any undue absences—a distinct gain from the educational standpoint; the hospital days were proportionally less, the children developed better, their physical condition showed marked improvement, the weight curve being especially encouraging. I am convinced that the cardiac school, when fully established, will reclaim most of these little sufferers and enable them to live useful and fairly comfortable lives.

## MEASLES EXPERIMENTALLY PRODUCED.\*

BY FRANCIS G. BLAKE, M.D.

Of the Rockefeller Foundation.

The author presented the paper of the evening in which he said, in part, that it was a familiar fact that measles occupied a prominent position among the acute infectious diseases that led to severe and often fatal diseases of the respiratory tract. This was particularly true of children under 5 years of age and of children in institutions. It was also true in the army; of this we had recently had an example in our own troops. The failure to control the complications of measles at the present time by isolation and symptomatic treatment gave rise to the belief that the more hopeful solution of the problem would be in prevention of measles itself. Strict quarantine had been largely inadequate because measles was most contagious during the prodromal stage. That the disease might be prevented by prophylactic inoculation was by no means a new idea. Many such attempts had been made by cultural studies and animal inoculation. The former method had not, up to the present time, yielded positive results, and whether the disease could be communicated to animals was still open to question. Anderson and Goldberger claimed to have communicated the disease to animals by inoculation of blood obtained from measles patients during the incubation period. The monkeys inoculated showed febrile reaction sometimes with and sometimes without a rash and rhinitis, but no mention was made of Koplik spots. Sellards and other investigators had attempted to transmit measles to animals and to human beings, with negative results.

Dr. Blake stated that the present study at the Hospital of the Rockefeller Institute for Medical Research was done with the collaboration of Dr. Trask. It seemed desirable to determine whether more evidence might not be brought to show whether animals were susceptible to inoculation with the virus of measles. It was the result of these experiments with which the present study was concerned. In the attempt to determine the susceptibility of monkeys to measles, it seemed desirable to utilize a method that gave opportunity for the transmission of the disease by the inoculation of a large amount of measles virus and by the

\*Special report for Archives of Pediatrics of a paper read before the New York Academy of Medicine, Section on Medicine, at a stated meeting held February 3, 1921, the President, George David Stewart, M.D. in the chair.



natural path of inoculation in man. It seemed that the virus in a human being infected with measles was present in the secretions of the respiratory tract and that the mucous membranes of the respiratory tract were the path of entry for the infection. The method employed was therefore to inoculate monkeys with nasopharyngeal washings collected by saline irrigation of the nasopharynx, using 5 to 10 c.c. of the nasal washings injected intratracheally. This method was open to the objection that other organisms besides the virus of measles were present in the washings and were injected into the trachea, but he believed these organisms were mostly saprophytes which were readily disposed of by the mucous membrane. To overcome this objection, the washings were subsequently filtered and the filtrate injected, and blood from infected monkeys, shown to be free from other organisms, was also used. Following injection, the method was careful observation of the skin, eyes, mucous membranes of mouth, nose and throat, morning and evening temperature and white blood counts. Cultures were made of the blood, both aerobic and anaerobic, in order to eliminate infections from other organisms, and finally small sections of the skin and mucous membranes were excised under anesthesia and submitted to histological study.

The attempt was made to transmit measles to 12 monkeys. Of these, 10, after from 6 to 10 days, came down with the group of symptoms characteristic of measles. One monkey died of an intercurrent pneumonic infection and another failed to show evidence of infection. Seven were inoculated with unfiltered washings and 3 with washings passed through a Berkfeld filter. Several control animals were inoculated with filtered and unfiltered washings, not containing measles virus, and none of these animals showed any evidence of measles infection. The symptomatology of the reaction induced in the monkeys by the inoculations of washings containing the measles virus was as follows: In monkeys inoculated on the respiratory mucous membrane, the incubation period was very constant, being never shorter than 6 days or longer than 10 days, and averaging about 7 days. During this period, the animals were perfectly well. The onset of the symptoms was marked by listlessness, drowsiness, loss of appetite, and a diminution of the leucocyte count. The conjunctivae became inflamed and small, discrete, hyperemic macules appeared on the labial

mucous membranes. Later a confluent, hyperemic, granular rash appeared over the lips and inside of the cheeks. One to 5 days after onset, a red maculopapular rash appeared, usually coming out first on the face. The exanthem spread to the chest, abdomen and inner side of the thighs, reaching its height in 3 or 4 days and then gradually fading. The appearance of the conjunctivae in the monkey was quite similar to its appearance in man. The acute catarrhal inflammation persisted throughout the infection. The inner canthus and palpebral conjunctiva was affected more than the bulbar portion. There was an increased mucoid secretion, lacrymation and photophobia. The conjunctivitis was never purulent in character. The exanthem in the mouth began with the onset of symptoms or within 24 hours afterward. These discrete, granular hyperemic maculae were seen on the labial mucosa and occasionally on the mucous membrane of the cheeks but not in other parts of the mouth. The maculae were 1 to 2 mm. in diameter and had minute bluish-white pin-point spots in the center—typical Koplik spots. These spots were few at first and they might pursue one of two courses: they might either disappear or a confluent rash might develop. From 3 to 4 days after the appearance of the exanthem, it began to fade and quite rapidly disappeared. The exanthem came out about the eyes, corners of the mouth and cheeks, beginning with small, discrete hyperemic maculo-papules in small clusters, and being 2 to 3 mm. in diameter. This rash gradually spread, reached its height and went through the regressive stages characteristic of measles, going on to desquamation. The rash might be sparse or it might be more extensive but it was rarely as thick or widespread as measles rash in man. The fever might go up to  $105^{\circ}$  or  $106^{\circ}$ , or the animal might go through the disease with little or no fever, or again the fever might be present only in the prodromal stage before the appearance of the exanthem. The white blood counts showed a constant diminution below the normal. This began before the symptoms were recognized and the diminution continued for several days. The degree of leucopenia was sometimes as low as 4,000 over a period of several days. The normal leucocyte count in monkeys averaged somewhat higher than in the human being, the normal fluctuation being from 15,000 to 25,000. After remaining low for 3 or 4 days, the leucocyte count gradually re-

turned to normal. Another symptom of infrequent occurrence was a moderate diarrhea. In only one respect had the reaction differed from the course of measles in man and that was that none of these monkeys had exhibited any evidence of rhinitis or bronchitis. The regularity with which this group of symptoms developed and its close resemblance to measles in man were presumptive evidence that the symptoms were due to the virus of measles and not to the ordinary organisms present in the mouth. Furthermore, it had been shown that the reaction occurred when monkeys were inoculated with filtered washings containing none of the ordinary mouth flora. The possibility that the reaction might be due to some filtrable toxic substance rather than to the living virus of measles suggested itself, but such possibility had been excluded by the successful transmission from monkey to monkey.

In the first experiments of passing the infection from monkey to monkey, the following procedure was adopted. A monkey was inoculated from a patient having measles and when the monkey came down it was killed and the abdomen, face and chest shaved, portions of the skin taken off and ground up in sand and normal saline solution. This was injected intratracheally into monkeys in the same way as the nasal washings. In this way it was carried through 6 animal passages. Nasal washings were collected from a patient 22 hours after the first appearance of the exanthem, and, with these washings, 4 monkeys were inoculated. These monkeys came down with the characteristic symptoms. Tissue emulsion from one of these monkeys transmitted the disease to 2 other monkeys, one of which was killed shortly after the appearance of the exanthem, and the disease transmitted to 2 other animals, and so on. It was interesting in connection with the continuous passage that the exanthem became much more marked and persisted for a longer period. In these experiments, there was the same objection as in the use of the unfiltered tissue washings, namely, that there might not be an entire absence of other organisms. The only organisms present, however, were the ordinary staphylococcus albus, which was present in small amount. It was desirable to develop a method free from this objection. This had been accomplished by the use of blood withdrawn from a monkey during the course of the reaction, after having determined that the

blood was free from other organisms. The blood was withdrawn from the monkey directly into sodium citrate solution and immediately injected into other animals. This procedure was carried out on successive days during the incubation period. Without going into the detail of these experiments, it was shown that blood withdrawn on the seventh day of incubation transmitted the characteristic reaction and that blood withdrawn on the 4 succeeding days transmitted the reaction. It seemed that the blood was not infectious during the early part of the incubation period. Experiments were carried out with the blood through 12 successive passages. During these experiments it was shown that as small an amount as 1 c.c. of blood was infectious when injected subcutaneously and also when injected intravenously. The infective virus was shown to be present in the plasma and not in the blood cells.

The development of immunity, following infection, was also investigated. If the experimental disease was analogous to measles, it should be followed by permanent immunity and this acquired immunity should make the animal immune against a virus of heterogenous source or infection, as well as against infection from the homologous virus. Six monkeys that had previously had an attack of the experimental disease, were subjected to re-inoculation at periods ranging from 12 to 254 days after recovery from the experimental disease. In 5 instances, the strain of virus was from a heterogenous source and in one case it was the same strain with which the monkey was originally inoculated after having been passed through several animals. None of these 6 monkeys showed any evidence of infection, while control monkeys, inoculated at the same time with equal amounts of the virus, came down after an incubation period of 6 or 8 days. It therefore seemed that one attack conferred immunity against subsequent infection and that this immunity was effective against heterogenous as well as against homologous virus. Four monkeys were injected intravenously and 2 intratracheally and it appeared that the animals were as immune to one method of injection as to the other.

Finally, histological studies were made of the lesions in the skin and mucous membranes. Tissue, consisting of small pieces of skin and mucous membrane, was excised under anesthesia and skin

and mucous membrane from monkeys killed after transmission were studied microscopically. The slides showed a multiplication of endothelial leucocytes and moderate exudate about the capillaries in the corium. The greatest cellular reaction was in the endothelial leucocytes. The leucocytes showed occasional mitotic figures. The lesions were in the upper part of the corium, close to the epidermis, hair sheaths and sebaceous glands. The earliest lesions in the epidermis were in the malpighian layer which showed minute foci of serous exudate, vacuolation of epithelial cells, and infiltration with large mononuclears. Minute vesicles developed in the cornified layer. Slides illustrated 3 stages in the development of the Koplik spots. The skin and mucous membrane lesions of measles had been well described by Ewing and Mallory, and Mallory had expressed the opinion that the lesion in the monkey was essentially the same as that in man.

In summarizing, Dr. Blake stated that there had been induced in monkeys, by the injection of nasal washings, a group of symptoms which showed the characteristic phenomena of measles. This reaction had been successfully transmitted by nasopharyngeal washings, tissue emulsion and blood through a considerable series of animals and the lesion had been shown to be histologically similar to measles in man. The conclusion was therefore warranted that the monkey was susceptible to measles and that the reaction produced in monkeys might with justification be called experimental measles.

*Discussion.*—DR. JAMES EWING said that in accepting the chairman's invitation to discuss Dr. Blake's paper he wished to make it clear that he was conscious of no particular qualifications which fitted him to discuss the paper, although he confessed to a long interest in this disease which once led him to spend considerable time in a careful histological study of the lesions of measles. He had enjoyed Dr. Blake's description of the careful, logical and systematic experiments which seemed to him a model of precision and accuracy, and for which reason the results were not a matter of chance but a certainty. If heretofore any one had doubted the possibility of the transmission of measles to monkeys he would not leave the hall with any further doubt. Dr. Blake and his associate were to be congratulated on the type of work and on their results. There was little to be said except to express the

hope that they would continue their experiments. He thought it would be interesting if Dr. Blake would discuss the characteristics of the pneumonia observed in these animals and compare it with the types of pneumonia following measles which they had seen in the Army. He would like to know whether Dr. Blake had made any histological studies on the animals dying of bronchopneumonia. With regard to the lesions of the skin, he had spoken of the proliferating endothelial cells about the capillaries. Dr. Ewing said he had spent many hours trying to find a specific structure, possibly a pathogenic protozoon. In this he had been unsuccessful though he had found a number of other interesting things in the endothelium and epithelium. It would be interesting to know whether Dr. Blake had observed any bodies in the stratified epithelium that might be lined up with those observed by Dr. Wolbach in typhus.

We needed no new experimental evidence to show that measles could be transferred from one individual to another. The work of Hektoen in 1905 had demonstrated this. Since the time of Horne, in 1770, many had used inoculation as a preventive against the disease. Then more recently Anderson and Goldberger had shown that measles could be transferred to animals. However, he had no criticism but only admiration for the work presented, since it was more detailed and convincing than any previous study. But satisfactory and convincing as this study was, he would like to point out a further duty for Dr. Blake and his co-workers in the attempt to make the work of practical benefit. One characteristic of modern science was that it did not concern itself sufficiently with practical results. Jenner's work was not conducted in a way that we today would consider strictly scientific, yet he was successful in transforming smallpox from a lion into a cat, though its cause was still undiscovered. So, while we knew a great deal about measles, the first step was to find how, by harmless inoculation, the disease could be prevented. No doubt that was the reason Dr. Blake had taken up this work as a preliminary step. We were to be congratulated that the work was being done by a man as competent as the report had shown Dr. Blake to be.

DR. LOUIS I. HARRIS said that when he heard Dr. Ewing confess himself rather nonplused to find something to add to Dr. Blake's presentation, it was a relief to him as he felt utterly un-

prepared to discuss the paper from the standpoint of the laboratory worker. He took it that his presence here was testimony to the fact that it was desired to make this work not merely of academic value, but a study that would have a practical application to the problems of those who were endeavoring to cut down the mortality from measles and the complications that followed this disease. The facts regarding measles were no doubt familiar to all present, but it might perhaps be well to recall them. Measles was often regarded by physicians as an extremely trivial disease, but it was not so trivial when one escaped from the provincial standpoint, which was inevitable if one was guided by personal experience alone. During the 12 year period, from 1900 to 1911, in 22 countries 32,000,000 cases of measles were reported with 366,000 deaths attributed to measles. It must be remembered that many cases of measles were not reported and that many deaths due indirectly to measles had not been recorded as due to this cause. In New York City, where for the past 20 years we had had fairly reliable statistics, there had been 547,482 cases of measles reported to the Department of Health—on an average of 27,374 annually. The total number of deaths from measles was 13,651. There was, however, no record as to the number of cases in which death was attributed to other causes, but in which measles was the direct or indirect cause. The average number of deaths annually reported was 683, or about 1 per cent. of all deaths, was attributable to measles. It would be extremely valuable to discover by some means how many deaths from bronchopneumonia and other diseases, which were directly due to measles, were missed in this statistical summary as a result of incomplete statement of cause of death on death certificates.

This work of Dr. Blake's brought us one step nearer the goal of prevention and control, such as we reached in the case of smallpox long ago. The problem was one that concerned particularly the children of pre-school age—those under 5 years. It had been found that in communities in which measles was prevalent that 93 per cent. of all cases occurred in children under 5 years of age. It was an important problem, not only in so far as it concerned measles but in relation to tuberculosis as well. The statement had been made that measles was a direct cause of tuberculosis. If it were, it was highly important that opportunity should

be given to drive home that fact by experimental and other demonstration. It was well known that in the Army measles created havoc by causing a predisposition to infection by the streptococcus hemolyticus. Had it not been for the sequence of measles, then streptococcus infection, and finally pandemic "influenza," there might not have been such a serious tale to tell. At all events, it seemed evident that measles bore a direct relation to the high mortality that ensued in the influenza pandemic. This was especially evident at Camp Beauregard where there were large numbers of men from rural communities who had not had measles and who therefore offered a large amount of susceptible material. Among these, the mortality and morbidity from measles was extremely high, it being estimated that measles contributed 31 per cent. of the deaths. The complications due to the streptococcus hemolyticus was the most potent cause of fatal sequelae. Measles was equally important to industrial camps. Dr. Harris referred to various attempts that had been made to vaccinate against measles and stated that the public health workers were watching for something to take the place of bungling and contrary methods for the control of measles that were now prevalent throughout civilized countries. In one country, there was no provision at all for dealing with measles; in another a bonus or money premium was placed on the reporting of measles. It would seem that the Hippocratic oath and the ethical traditions of the medical profession should make unnecessary the giving of a bonus for the reporting of disease. In many countries, the enforcement of the law requiring the reporting of measles, as indeed the public health measures employed for its control, were ineffective. It seemed that all these facts argued for the continuance of such methods of research as had been presented this evening, in the hope that some method of dealing with measles, comparable to the Schick test and active immunization in diphtheria, might be discovered which could be applied *before* exposure to measles, and which would prevent the disease or delay it until that age at which it produced little or no disastrous effects.

DR. WILLIAM P. NORTHRUP said he could truthfully say that he had not expected to discuss the paper but he would not do justice to his feelings if he did not express his appreciation of the paper of the evening. He did not think it necessary to argue



for the importance of measles. At the Foundling Hospital, they had always been punished with measles in fearful epidemics, and that institution was no exception. If there was anything that would make a sister of charity turn pale it was to hear the doctor say "measles." If there is an epidemic in any institution it is something fearful. The same was true of camps and jails and in public institutions of all kinds. It was one of the worst things that could happen. In the Foundling Hospital, they had been able to control diphtheria and smallpox, but when it came to measles they were helpless. About the sequelae, he was glad the last speaker had touched upon that point, for he was accustomed to think that there were 2 diseases that children had that should be watched very closely—measles and whooping cough. After a child had had measles, one should always ask whether it had made a good recovery, and ascertain some of the details in reference to recovery, as how long the child had been in bed and how quickly it made a good recovery after measles. The same was true of whooping cough. It was a fearful thing not only in its immediate effects, but in the possibility of tuberculosis, particularly in those glands at the bifurcation of the trachea and at the root of the lung. The complications and sequelae of measles and whooping cough were worse than those of scarlet fever or of any other disease.

Dr. Blake spoke of the monkey having no rhinitis. He thought that was rather peculiar. There was an eruption of the mucous membranes and of the cutaneous surface, on every part of the mucocutaneous surfaces in contact with the atmosphere. He did not see how the monkeys escaped the rhinitis unless it was that the monkey's nose had a good vent and did not show the rhinitis.

Dr. Northrup said that in a long time he had not heard such a beautiful paper, one possessing such logical perfection, such dignity, such beautiful simplicity. He wished all students could hear it for those beautiful qualities and also for its summary and ending, and the dignity and clearness with which it was delivered.

DR. RUFUS COLE stated that he had nothing to do with Dr. Blake's work but to be interested in it and to support it. His great interest in measles had been aroused by his experience in Southern camps where he discovered for the first time what a dreadful disease it was when complicated with streptococcus pneumonia. It was the worst experience he had ever had although he

had had some experience with smallpox, so it seemed to him that measles was an extremely important disease to be studied in the Hospital of the Rockefeller Institute. Dr. Blake's experience had been similar to his and he had come back to the Rockefeller Institute to undertake these studies, the results of which he had presented. Both Dr. Blake and Dr. Cole, being clinicians, were naturally much interested in the practical aspects of the question, but he felt that little could be accomplished in a purely empirical manner and that first it was necessary to obtain scientific experimental evidence upon which to base practical preventive measures. He hoped that with the results already obtained Dr. Blake could now proceed to the practical applications of his work and that later he could report upon the results of these endeavors.

DR. WARFIELD T. LONGCOPE said that he felt very much as the other speakers had expressed themselves, that one might go on speaking indefinitely with admiration but it was quite impossible to discuss a paper so logical in its sequence and so convincing. Dr. Ewing and others had mentioned that the disease had previously been transmitted to animals and many had attempted to transmit it without success. The thing Dr. Blake had done was a perfectly original piece of research. He had attacked the problem from a new standpoint and by new methods and had obtained entirely new results. He had developed a method by which this disease or virus could be cultivated in animals in a definite way which brought similar results to those reached in bacterial diseases studied in a similar way. This piece of work constituted a wonderful basis from which to proceed further. One need not suggest the important possibilities which were obvious to all. He supposed Dr. Blake had gone 10 years ahead of other investigators in devising methods of inoculation.

DR. CHARLES HERRMAN said he agreed that this piece of work was the most thorough that had been done on this subject. It was much more complete and the number of animals was larger. The results agreed in the main with those of Anderson and Goldberger, but their work was not so extensive and this work was very much more conclusive. The negative results obtained by some investigators was due to the fact that they did not use active material, or the material was not obtained at the right time, or the subject of the experiment was already immune to measles.

Frequently an individual had had a mild attack of measles when there was no statement in his history showing that he had had measles. It was well known that an individual might have measles in such a mild form that the disease would not be recognized unless there was another case of measles in the same family. As the infecting agent was present in the filtrate it was improbable that the diplococcus isolated by Tunnecliffe was the cause of the disease.

Dr. Herrman stated that he was interested in the question from the practical side. A method of immunization to be of practical value must be similar to that used in immunization against small-pox and must be one that could be used early in life. His method was crude, but it had yielded some rather convincing results. Since practically all mothers in New York City had had measles, all children under 5 months of age were relatively immune; those under 2 months were absolutely immune, those between 2 and 5 months were relatively immune. The easiest method of inoculation was by the way the disease was usually transmitted, that was from mucous membrane to mucous membrane. All that was necessary was to take some of the secretion of the nasal mucosa from a measles patient just before or just after the appearance of the eruption and transfer it to the nasal mucous membrane of the susceptible animal or human being. Three per cent. of all individuals were naturally immune, otherwise the disease was transferable, and a relative immunity in infants from 3 to 5 months might be changed from a temporary to a permanent immunity. If the immunity thus conferred lasted only a few years, a great deal would be gained because practically all the deaths in measles, due chiefly to bronchopneumonia, occurred in children under 5 years of age. Dr. Herrman stated that he had carried out this method in 150 infants, but, as all knew, it was extremely difficult to follow up a large number of infants over a long period of time. He had begun the inoculations 5 or 6 years ago. While in the Service, follow-up work had to be discontinued. However, he had been able to follow up 25 children who had been inoculated and subsequently exposed to measles. Of these 25 children, only 2 contracted measles. When one considered that ordinarily 95 to 97 per cent. of all infants and children who had not had the disease became infected when exposed, it seemed that it was perfectly

possible to immunize. There were 2 points, however, that must be observed. The material used for inoculation must be bacteria-free and some method must be devised by which the material could be preserved. Dr. Herrman expressed the belief that it was perfectly possible to immunize against measles as we immunize against smallpox.

DR. BLAKE, in closing the discussion, said only one of the monkeys had died of bronchopneumonia. Dr. Ewing had asked if he had looked for the Wolbach foreign bodies. He had used appropriate stains on a large number of sections but had been unable to see any of these bodies. Dr. Harris had emphasized the importance and seriousness of measles as a public health question. He could add an instance showing the popular recognition of this fact. A woman in New Rochelle was very much exercised because there were 2 or 3 cases of smallpox in that locality and wondered whether she should have her children vaccinated. She finally said she did not know that it was necessary to have the children vaccinated because smallpox did not mean anything compared with measles.

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ETIOLOGY OF LETHARGIC ENCEPHALITIS (Policlinico, Rome, Sept. 27, 1920). Ottolenghi and his co-workers report findings which confirm those of Maggiora in respect to the filtrability of the virus found in the blood and spinal fluid of patients with lethargic encephalitis, and that this virus will transmit the disease to guinea-pigs when injected into the peritoneum or brain. The disease is also contagious for guinea-pigs when washings of the nasopharynx are instilled in the nostrils. This occurs also in rabbits, but only when the nasal mucosa has been first scarified. Cats are also susceptible, and the brain substance of the infected cats is virulent for the guinea-pig. The bacteriologic findings were constantly negative except in one case in which a streptodiplococcus was found resembling that described by Wiesner in 1918. They have now 2 strains of virus which have stood 12 and 8 passages. The experimental disease lasted for from 5 to 35 days and proved fatal in all but 13 of the 215 guinea-pigs inoculated.—*Journal A. M. A.*

## CLINICAL DEPARTMENT

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CASES CONTRIBUTED BY

WILLIAM WESTON, M.D., Columbia, S. C.

H. M. McCLANAHAN, M.D., Omaha, Nebr.

CASE No. 7.\* W. M. J., Jr., age 21 months, was admitted to the Columbia Hospital, May 24, 1918, having been sent to me by a physician from a nearby town for diagnosis and treatment. The physician who came with the infant gave the following account of the illness: He was taken sick 1 week ago with an attack of vomiting, slight fever, and was very restless and irritable. He soon became drowsy and now sleeps most of the time. He has been rather constipated. He has little desire for food or water, but will take a small amount of either milk or water when aroused, then almost immediately falls asleep. Sometimes he has to be repeatedly aroused in order to finish taking his accustomed amount of milk. He passes his urine and feces involuntarily. The temperature has been constant from the beginning.

*Family History.* Both parents are alive and well. Two children living, the other a strong, robust boy. No miscarriages. No history of tuberculosis, rheumatism, alcoholism or diseases of the nervous system in the family.

*Personal History.* Second child, born at full term, normal delivery, weight at birth 8 pounds. Breast fed until the thirteenth or fourteenth month. He sat up at about the 5th month, cut teeth at 6th month, walked at about 14th month, and began talking about the same time.

*Health and Habits.* Until recent illness appetite was good, bowels regular and did not eat between meals. He lived largely in the fresh air, and took a nap each day about the middle of the day. Slept well at night. The only illness was a case of chicken pox when about 6 months old.

*Physical Examination.* He is well nourished and well developed. He has the appearance of being very sick. It is difficult to arouse him and when aroused does not appear responsive to questions and seems indifferent to toys. It is with difficulty that he is kept awake for more than a few minutes. He lies with his eyes partially closed. The pupils respond to light sluggishly, the conjunctivae are congested. Ophthalmoscopic examination shows

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\*Encephalitis lethargica.

the fundi normal. At times the neck seems a little rigid, also the arms and legs, but this is by no means constant. The Babinski reflex and Kernig's sign are negative. The organs of the chest and abdomen seem normal. The skin is clear, no eruption appearing on any part of the body. There was no paralysis present at any stage of the illness.

The above described condition lasted for 6 weeks with the following exceptions: After he had been sick for 2 weeks he set up a diarrhea which lasted 6 or 7 days, followed by a mild bronchitis which lasted 4 or 5 days. Convalescence was slow and it was not until the eighth week could he have been considered normal. Pulse usually from 95-120. Temperature ranged from 100° to 105°. Respiration from 12-30. The von Pirquet test was negative, 5 tests having been made. The urine was normal. The blood findings were as follows: Total leucocytes, 10,500, polymorphonuclears, 43 per cent.; small lymphocytes, 50 per cent.; large lymphocytes, 6 per cent.; eosinophiles, 1 per cent. Malaria, negative; widal, negative; Wassermann, negative. Spinal fluid: Clear; cells 2; globulin negative; Wassermann, negative. No organisms present after prolonged centrifugalization.

*Diagnosis*.—Undetermined at the time. Later, encephalitis lethargica.

*Treatment*.—Symptomatic.

The literature on this subject, especially during the year 1919, has been so voluminous both from American and foreign observers, that it does not seem worth while at this time to undertake to discuss the subject fully. I do, however, desire to call attention to 2 particularly interesting phases of the subject, the second of especial interest to pediatricists.

First: there has been a great deal of discussion as to whether encephalitis lethargica was a disease entity or whether it was a manifestation of influenza, as is claimed by certain excellent observers, or a form of poliomyelitis, which contention is ably defended by others, mainly clinicians.

I do not feel that anyone can carefully read the excellent report of the Local Government Board on Public Health and Medical Subjects published in London in 1918 without being impressed with the force of the thoroughness and scientific effort

that was made in order to arrive at a definite conclusion in regard to this point.

McIntosh considered the matter in its appearance in some respects to botulism. He studied it both from a cultural and serological point of view and concluded that there was no relationship between the 2 diseases. Its similarity to poliomyelitis was studied on clinical grounds by MacNally, epidemiologic by James, experimental by McIntosh, and pathologic by Marinesco, all coming to the same conclusion that it was a disease entity and not a form of poliomyelitis.

I feel that the strongest argument that has been presented by the adherents of the theory that encephalitis lethargica was merely a manifestation of influenza is that the appearance of the 2 diseases were synchronous on several occasions. We might with equal force claim that bronchopneumonia or some cases of membranous diarrhea bore the same relationship, because bronchopneumonia frequently follows influenza and there is a striking similarity in many respects between membranous diarrhea and encephalitis lethargica.

Second: In my search of the literature I have failed to find a case reported under 3 years of age. It is possible however, that in some of the many series of cases that have been reported, and in which reference has only been made to a child without specifically mentioning the age, that some may have been observed, and the age incidence might have been omitted as of no material interest or importance. On account of the time which the case reported was observed (May, 1918), which was several months before the beginning of the influenza epidemic, and on account of the kind of food that the child took, both influenza and botulism may be dismissed from consideration as having even a remote relationship to this case.

WILLIAM WESTON.

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CASE No. 8.\* Since June, 1919, we have had under our care and treatment 6 cases of congenital hypertrophic stenosis. All of these cases complied with the following syndrome of symptoms, namely, loss of weight, vomiting several times a day, frequently

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\*Hypertrophic Pyloric Stenosis.

Read before the 32nd Annual Meeting of the American Pediatric Society, held at Hyde Park, Chicago, Illinois, June 1, 2 and 3, 1920.

expulsive in character, stools small and dark without any evidence of milk digestion, visible peristaltic wave, and scanty urine. On palpation, in 3 of the 4 cases recovering without operation, the thickened pylorus could be felt. In 1 of the 4 cases not operated upon, the diagnosis was further confirmed with roentgenogram plate. Four of the 6 cases recovered without operation. Their ages respectively, when they came under observation, were 5, 5, 7 and 11 weeks. These cases were placed upon a thick gruel feeding in the manner described by Dr. L. W. Sauer and later by Dr. Langley Porter in the ARCHIVES OF PEDIATRICS, July, 1919. The rate of gain varied, but all made a slow but steady improvement. After returning home I have had regular reports from all of these cases. Their ages and weight on May 20 were as follows:

Baby G.....	11 mo.	18 lbs.
Baby R.....	9 mo.	14½ lbs.
Baby M.....	5 mo.	12½ lbs.
Baby B.....	7 mo.	13¾ lbs.

The fifth case, Baby B, came under our observation January 2, 1920. This infant made fair progress for 2 weeks, but the parents, seeing the result of an operation on the next case to be reported, demanded an operation. Operated on by Dr. A. F. Jonas, February 2, 1920. It rallied slowly, but after 24 hours made a steady gain in weight. On May 20, its weight was 16 pounds, 12 ounces; age, 6 months. As the parents of this infant live in Omaha, I have seen it on frequent occasions. It is my belief this infant would have recovered without operation.

The sixth case, Baby H., I wish to report more in detail. Infant born December 2, 1919. Birth weight, 10½ pounds. Breast fed for 2 weeks, when it began vomiting. Weaned at the end of 4 weeks. Brought to the hospital under our care January, 1920. Attempt made to establish breast feeding without success. Weight on admission, 7¾ pounds. Parents healthy. Continued on gruel feeding from January 1 to 24. During this period it lost one pound in weight. January 4, developed a temperature of 104°. Lungs and heart negative. January 9, exudate was observed upon the tongue and cheek. Stain made from this culture revealed staphylococci. No mycelium. From January 20 to 24, the vomiting was more persistent, and the vomited matter consisted chiefly of mucus with many blood streaks and occult blood upon test. On



the morning of the 24th, the temperature was 105.5°, and for 24 hours there had been complete anuria. On this day, the father implored us to have the infant operated upon. Operation at 3 P. M., performed by Doctors Kennedy and Henske. Infant was on the table 17 minutes. The pyloric mass was simply incised down to the mucous membrane. The stomach was greatly dilated and dark in color. As soon as the incision was made, gas escaped freely from the stomach into the bowel. At my suggestion, 10 ounces of sterile normal salt solution was instilled into the peritoneal cavity during the operation. Infant placed in bed with hot water bottles. Five per cent. glucose solution given by Murphy drip and retained. Infant rallied slowly and 2 hours after operation  $\frac{1}{2}$  ounce of water was given by the mouth by medicine dropper every half hour for the first 24 hours. January 25, 9 A. M., temperature 104.6°, but at 6 P. M., temperature had subsided to normal. On the evening of the 25th, the following formula was given:

Whey .....	1 oz.
Sterile water .....	1 oz.
Sodium citrate .....	1 gr.
2 oz. every 3 hours.	

One stool, dark in color; kidneys, however, acted freely. 26th, the temperature was normal. Emesis twice in 24 hours. After this date, the stools were yellow in color. Kidneys continued to act freely. This formula was gradually strengthened by the addition of milk. February 1, profuse discharge from the left ear. Dr. Wohl (pathologist) reported staphylococci. From the date of the operation until March 20, the improvement was very slow. the weight varied from day to day, but on the latter date there was a gain of one pound. The infant returned home weighing 7 $\frac{3}{4}$  pounds. Weekly reports from the baby after its return home showed a more rapid gain in weight. On May 20, 1920, its age was 5 $\frac{1}{2}$  months and weight 12 pounds. Parents reported in letter that infant was well and active; stools, normal; no vomiting.

At the operation, the wall of the stomach was seen to be dark in color in striking contrast with that of the intestines. We were, therefore, dealing with an infant with congenital hypertrophic stenosis, a general staphylococcus infection, and undoubtedly an acute gastritis. This was the most critically ill infant I have ever

seen placed on the operating table, and I have no doubt that the case would have terminated fatally without an operation.

*Conclusion.* The writer has had the opportunity of observing a number of cases of pyloric stenosis during the last 10 years. Many of these recovered with operation, and some where the operation was refused, died of inanition. The thick gruel feeding is a decided advance in the treatment and worthy of trial in all cases. Where this fails, recourse can be had to surgery. Success of the treatment depends largely on the coöperation and perseverance on the part of the mother or nurse.

H. M. McCLANAHAN.

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CONGENITAL STEATORRHEA (*Quarterly Journal of Medicine*, London, Oct., 1920). A clinical analytical study of a case of congenital steatorrhea is reported on by Miller and Perkins, and it is compared with the only previous example of the condition as yet reported. The term steatorrhea, which has sometimes been used to cover all cases in which an obvious excess of fat is passed in the stools (fatty diarrhea, diarrhea alba), is here used in its more correct and restricted sense, namely, as indicating a passage from the bowel of separated liquid fat which congeals on cooling (*Butterstühle*). The patient passed separated liquid fat since birth, and persisted in doing so, except on a diet markedly low in fat content. Yet this failure in the absorption of fat did not result in any definite stunting of the child's stature by the age of 3 years. Although the power of fat splitting was somewhat impaired, more especially on diets rich in fat, the failure in fat utilization did not appear to be merely dependent on this factor. The urinary diastase figure was normal; Loewi's pupil test was negative. More particularly, there was found no microscopic evidence of failure in protein digestion. The authors agree with Gartod that there is an "inborn error of metabolism probably due to the absence of a normal enzyme, presumably a pancreatic enzyme. It is difficult to believe that there is any real disease of the pancreas."—*Journal A. M. A.*

## MISCELLANY

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### TYPHUS FEVER IN NEW YORK CITY.\*

In view of the fact that typhus fever is epidemic in many sections of Central Europe and Asia Minor, it is a matter of paramount importance to adopt every precaution to keep this disease from gaining headway in this country. Bearing in mind the innumerable channels of communication that exist between the affected countries and our own, and considering the enormous number of immigrants who reach these shores from countries in which they may have been exposed to infection, it will be seen that a note of warning to physicians, in particular, and to hospital superintendents, is timely so that no case of this disease may be overlooked. Unless physicians are on their guard, and keep in mind the varied manifestations of typhus fever, cases may be overlooked and be allowed to mingle freely with others in the community, thus laying the groundwork of a community outbreak.

While the Department of Health feels that the present situation is by no means alarming, it desires to bring to the notice of all physicians, particularly those in districts from which cases are reported, the cardinal symptoms by which the disease can be recognized, and for which they should be constantly on the alert. While the identity of the organism which is responsible for typhus fever has not been thoroughly established, we know that the body louse is the chief host of this organism and that the presence of such a louse is a distinct menace, particularly when found on immigrants coming from affected countries, or on those who have been in contact with such persons. It takes from 4 to 12 days for the disease to develop in an individual who has acquired the infection. The prodromal symptoms are extremely vague and, because of the lack of any characteristic symptom, they may be thought to indicate influenza, or other affections. The actual onset of the disease is sudden, beginning with frontal headache of very great severity. At the onset, there may be a chill, and there is a considerable elevation of temperature, which is maintained throughout the disease. The face becomes flushed, the eyes suffused, and respiration is quickened, and the patient usually complains of a sense of great weakness. The temperature may reach 104° to 105° from the second to the fourth day of the disease, and continue until near the termination of the malady. The pa-

\*From the Weekly Bulletin of the Department of Health, City of New York, February 12, 1921.

tient is usually drowsy and dull, or may be delirious. A rash appears on the fourth to fifth day, and consists of macules; appearing on the abdomen first, and, later, on the chest, and then on the arms and legs. These macular spots may become petechial. With the appearance of the eruption, the nervous symptoms frequently become more marked. The disease terminates in the majority of instances by crisis. In some cases, it ends by rapid lysis. In fatal cases, the patient passes into coma before death.

From the public health standpoint, the important thing, in all instances, is to discover whether the patient is a recently arrived immigrant, or has been in contact with any person who has been abroad in the affected countries. Also one should ascertain whether the patient or other members of the family give evidence of pediculosis, in which case such persons are to be thoroughly deloused at once, by the use of kerosene oil, followed by a thorough shampoo with creosol soap, and the washing of hairy parts, or equally effective treatment. The clothing is to be thoroughly disinfected by heat. All such cases should be promptly reported to the Department of Health, so that it may take such measures as are necessary for the proper care of the patient, and the protection of the public.

CASE REPORTS.—Case I. Mrs. M. B., 58 years old, was taken sick on January 10, with high fever and headache. Her temperature has continued between  $103^{\circ}$  and  $105^{\circ}$  up to the time of writing. Her headache is persistent and on January 14, a macular rash appeared on trunk and extremities. This rash is now becoming petechial. There is congestion of the eyes. The persons and surroundings of this patient are cleanly. The Weil-Felix agglutination test was positive. There is no evidence nor likelihood of vermin. There is no discoverable connection with recent immigrants.

Case II. J. H., male, 18 years. The history of this case is a little uncertain, but it appears that he had been sick since January 16, with severe headache and fever. He entered St. Mary's Hospital on the 27th, with a temperature of  $104^{\circ}$ , a pulse of 140, delirious, and, plainly, in considerable pain. The widal test was negative; leucocytes, 26,000; spleen not palpable; tongue badly coated, herpes on the lips; and constipation present. Patient had a most profuse macular rash, dark red in color, the macules uniform in size, arranged over his trunk and arms. The temperature

started to fall by step-like lysis, on January 28, and on January 31 it nearly approached normal. The macules were still very much in evidence and did not fade on pressure. This man was born in United States, has not been out of town in a long while, has seen no visitors from foreign countries in the recent past, and no pediculi were noted on this person, though his body was much scarred with scratch marks.

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RETENTION OF BREAST MILK (Archives de Médecine des Enfants, Paris, Nov. 1920). Porcher tabulates data sustaining his assertion that if the mammary gland is not thoroughly drained of its contents, there is retention of some of the milk and that this tends to check the secretion of the gland. Less solid matters pass into the milk so that the milk seems impoverished and watery; there is no more water than usual but less of other elements in the milk. The fat and the proteins in the milk which normally drain away in the milk behave as foreign bodies in the mammary gland when retained. This explains many phenomena observed, and particularly the passage of lactose into the urine. Whenever there is lactosuria, we can be confident there is retention of milk.  
—*Journal A. M. A.*

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CHOLERIFORM DIARRHEA IN INFANTS (Nourrisson, Paris, Sept., 1920). A. B. Marfan remarks that this is generally primary. The one feature common to all the choleriform sets of symptoms seems to be the defective functioning of the epithelium lining the intestines. In Asiatic cholera and in cholera morbus, there is desquamation of the intestinal epithelium. In normal conditions this epithelium transforms the poisonous substances in the bowel or destroys them; when this toxicolytic function is arrested or vitiated, the unmodified toxins bring on the choleriform set of symptoms. Even when the source of the poisons is removed, by restriction to water, the damage done may persist for some time. The injury of the intestinal epithelium may be from microbial toxins or from arsenic or other drugs acting on the epithelium, or from the poisons generated in the course of pneumonia or military tuberculosis. In short, he concludes, the choleriform syndrome is in digestive disturbances what uremia is in kidney disease, or asystole in heart disease: It is the manifestation of a transient or permanent lapse of the toxicolytic function of the bowel epithelium.—*Journal A. M. A.*

## SOCIETY REPORTS

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### THE NEW YORK ACADEMY OF MEDICINE. SECTION ON PEDIATRICS.

*Stated Meeting, Held December 9, 1920.*

CHARLES HENDEE SMITH, M.D., *in the chair.*

#### THE TONSILS AND SCARLET FEVER.

DR. JESSE G. BULLOWA made this presentation, which was based on a study of 153 cases of scarlet fever in respect to tonsil size, covering and compression, severity of the rash and the occurrence of lymph-node involvement. He demonstrated that the intensity of the rash did not affect the severity of the disease but that it was very much aggravated by enlarged lymph-nodes which were due to infected tonsils and especially if they were covered and so swollen as to be compressed on swallowing. He also showed that of 22 asymmetrically diseased tonsils, 6 showed homolateral lymphadenitis involvement of the lymph-nodes and that in 16 tonsillectomized cases there was no adenitis, the disease was not severe and there were no deaths, although some of the patients showed very severe rashes. Dr. Bullowa regarded the severe cervical adenitis as an epiphenomenon of scarlet fever which should be treated, though a phlegmon on the pharynx, as any other phlegmon. Tonsillectomy, when the tonsils were buried or covered with plica, was a prophylactic against the severer septic forms of scarlet fever. Incision of the plica to relieve pressure, and in exceptional cases tonsillectomy, was recommended.

*Discussion.*—DR. HENRY KOPLIK said he considered this paper a very valuable contribution to the pathology and clinical symptomatology of scarlet fever. It presented many points of view and many points to set one to thinking. However, it should not be forgotten that scarlet fever, according to an eminent authority, Henoch, was a very insidious disease. It was a general infection, not an infection from any local point, but a general infection of the entire body, and not only were the glands and lymph-nodes of the neck affected but the glands and lymph-nodes all over the body. If one examined a case of scarlet fever, whether mild or

severe, he would find nearly every gland involved—in the groin, in the axilla and in every part of the body. In every case of scarlet fever, the tonsils were involved more or less, so that this involvement of the throat became a diagnostic point of value, especially in mild cases or in those in which the rash was not well defined.

A point to make one think a great deal was that those cases of scarlet fever which were tonsillectomized did better than those which were not tonsillectomized. This, Dr. Koplik said, might be true to a degree but he could not forget those cases in which tonsillectomy had been done in whom scarlet fever assumed a most severe type and involved the throat and glands at the angle of the jaw, and not only that but the tonsillar ring was also involved. If one looked at Sappey's anatomy, he would see how interminable were the lymphatics of the throat and nose and would realize that by removing the tonsils only a very small part of the lymphatic structure of this region had been removed. In scarlet fever, the whole lymphatic system was involved and therefore the removal of the tonsils did not absolve the throat from involvement, if a child contracted scarlet fever. Indeed, some severe and even fatal cases of scarlet fever had occurred in patients who had had their tonsils removed. The same facts were true of grippe, angina and diphtheria. The fact that a child had had his tonsils removed did not prevent him contracting angina, diphtheria, grippe or scarlet fever. For example, in grippe, where the tonsils had been removed, the tonsillar ring and the posterior pharynx would be involved to such an extent that they might look as though injected with carmine, and all the glands would be enlarged and inflamed. Dr. Koplik cited the case of a boy who was subject to periodical attacks of angina who had his tonsils most skillfully removed, and he still continued to have the attacks as before the tonsils were taken out. He had seen many of these cases. Those who dilated on the advantages of tonsillectomy as a prophylactic measure should not forget these cases. It was nothing new to take out the tonsils during scarlet fever. He was glad the subject had been brought up because it was desirable to work it out further. In one case of scarlet fever which he recalled, a colleague had wished to take out the tonsils and he had remonstrated. However, the tonsils were removed and successfully and the child did well, but

he would hesitate to repeat that procedure too often in scarlet fever, since he was rather backward in adopting such heroic measures, though he knew they had been employed and employed successfully in certain cases, and the operator had been able "to get away with it." There were a great many cases of scarlet fever in patients with necrotic tonsils, suppurating adenitis, otitis media and even necrotic bone in the mastoid. The latter did well with simple incision and drainage. In other words, scarlet fever was not a disease which enabled one to draw conclusions, and the reader of the paper, very wisely, had drawn no conclusions, but we should not forget these severe cases that did well without tonsillectomy. There were cases in which the tonsils were not involved to any extent in which, at the end of 10 days or 2 weeks a tonsillitis with adenitis developed and the patient went through a very severe illness, accompanied by suppuration of the glands and disease of the tonsils, and other complications, all after the tonsils had been judged to be well.

The principal objection to tonsillectomy during scarlet fever was that it opened up a large field for the absorption of bacterial toxins, and it was a question whether one was justified in doing that. We should not forget that there were a number of cases in which tonsillectomy was done and death ensued.

DR. CHARLES HENDEE SMITH cited a case which was under his care last winter which illustrated 1 or 2 points Dr. Bullowa had mentioned. This child had a bad throat, large tonsils and a rather acute scarlet fever. On the sixth day, an adenitis developed with a great deal of swelling of the glands. The temperature subsided and then went up. The case was somewhat puzzling for a time and then it was found that the child had mumps as well as scarlet fever. All 4 salivary glands were involved. It was learned then that there had been an exposure to mumps just 17 days before the trouble began. The case was interesting from the fact that there were 3 sets of glands involved, some of them being as large as a walnut. He saw the child 6 months later and all the glands had disappeared.

DR. ROBERT J. WILSON said that from the administrative side something might be said. When Dr. Bullowa first proposed this investigation, he was told that he might carry it out if the parents gave their consent to the tonsillectomies and if, in his



judgment, he was going to do more good than harm. Dr. Wilson stated that he had watched these cases with interest and of one thing he was sure, namely, that they could not apply this procedure as a routine proposition. He would simply say, "if, in the surgeon's good judgment, it looks like a case that can be operated upon, and the local condition in the particular patient indicates it, go ahead and operate." There was no doubt that some remarkably favorable conditions followed operation and he had seen exactly the same things when no operation had been done. He did not mean that Dr. Bullowa's and Dr. Crawford's judgment was not good, for it was, but in all these innovations it was to be understood that they were not used as routine measures. Dr. Koplik had put it well when he stated that this was a contribution and that one should go along slowly with things of this kind. So far as the Health Department side of this work was concerned, when the Willard Parker, the Kingston Avenue, Riverside or other Department Hospitals turned out a piece of work of this kind, it was to make physicians think, but it was not intended that such things should be adopted indiscriminately in every case. Dr. Bullowa felt, however, that the children who had had their tonsils removed stood scarlet fever better than those who did not.

DR. BULLOWA, in closing the discussion, said that scarlet fever, if there was such a disease and some even questioned it, had been described as a disease with a general lymphadenitis, and that Dr. Koplik had emphasized the point. However, the point of view might be presented that the large palpable lymphatic nodes were a response to the inflammatory involvement of the skin. He had observed that where the rash was slight or took a peculiar distribution, the enlargement of the lymph-nodes was not symmetrical, and that where there was the most rash there one got the largest lymph-nodes. The point that the involvement of Waldeyer's ring and the adenoids was an important factor needed no emphasis. He had emphasized in the paper that it was the rhythmic pressure which was responsible for the forcing of the toxins into the lymphatic system, and the same thing might occur with the adenoids if they were so large that they pressed against the structure on the posterior surface of the maxilla. Of course, the proposal of tonsillectomy in scarlatina was not original or new. Similar work had been done in Boston by Dr. Place who reported 12 cases operated in the acute stage. It was work that

could not be done by the family doctor or a general surgeon, but must be done by a skilful operator, for the operation had to be done quickly and had to be clean cut, behind the capsule, so that there would be no wide opening up of lymphatics. As to the question of operating in the acute stage of scarlet fever, in the army there was a large number of cases of streptococcus infection of the tonsils which were operated upon successfully in the acute stage. Of course, cases got better in spite of a long drawn out illness, but in the group of 5 cases there was one case, A. G., which was operated upon and got better; the others did not get better. Dr. Bullowa said any procedure that promised to reduce the mortality of scarlet fever was worth trying out.

#### PRECOCIOUS PUBERTY.

DR. MARK S. REUBEN stated that his paper was based upon a study of 7 personal cases and 390 cases reported in the literature. Precocious puberty was not a distinct entity; it might be due to various causes; the symptoms varied with the causes. An attempt was made to differentiate the various types clinically from a study of all cases that came to autopsy or operation. Of the 397 cases studied, 326 were females and 71 males; of these there were 188 females and 57 males, in whom definite etiological factors were lacking. In 23 cases, there were tumors of the ovary; in 9 cases (8 females and 1 male), there was hyperplasia of the adrenals, or adrenal rest; in 21 cases, there were tumors of the adrenals (17 females and 4 males); in 7 cases, there were tumors of the pineal (all males); in 1 case, there was a tumor of the testicle and in one case, a tumor of the prostate with metastases in the testicle. In 83 cases, precocious puberty was associated with precocious pregnancy.

In females, menstruation was the first symptom of precocious puberty; it might be present at birth; at first it might be irregular, and might have molimina. The breasts were usually enlarged in all cases; the external and internal genitals showed marked development. Hair was usually present on the genitals and in the axilla. The voice deepened and there was a lengthened physical growth, but owing to premature ossification there was no tendency to gigantism; on the contrary, at the time of real puberty, these individuals were somewhat undersized for their age. In most cases, this was accompanied by an increase in muscular

power and in adipose tissue. There was broadening of the pelvis. Dentition, in a number of cases, was early. Onanism was present in only a few cases; early sexual desire was usually not present. Mentality usually corresponded to the real age, though a few were precocious. In the males, erections and ejaculations took place; physical development was marked; they became very muscular, athletic and strong. The secondary sexual characteristics made their appearance. In 15 males, the mentality was normal; in 15, deficient; and in 4 precocious. Libido was increased in a few. In case of precocious puberty, due to tumor of the ovary, menstruation was always present; the external and internal genitals were always enlarged; pubic and axillary hair were always present; the breasts were enlarged in 75 per cent. of the cases, and in 90 per cent. of the cases the mentality was normal.

In cases due to tumors of the adrenals, there was a tendency to produce maleness in the females and to exaggerate maleness in the males. The internal genitals were usually not enlarged; the external genitals usually showed enlargement of the male type of females (enlargement of the clitoris); the breasts did not enlarge, and menstruation was usually not present; there was a tendency to growth of a beard in females, and to overgrowth of genital, axillary and general bodily hair growth. There was marked tendency to adiposity; in 70 per cent. of the cases, there was mental backwardness. This condition was far more common in females.

Tumors of the pineal gland were more common in males; both external and internal (testicles) genitals were enlarged; there was pubic and axillary hair growth; these individuals all showed marked adiposity and all had manifested cerebral symptoms. In 80 per cent. of the cases, mentality was normal, and in 10 per cent., it was precocious. In one case of precocious puberty, due to tumor of the testicle, the genitals were enlarged; there was general hair growth and marked physical development. After removal of the testicle, there was complete reversion to childishness.

Of the 84 cases of early pregnancy associated with precocious puberty the ages at the time of delivery were as follows: in 1 case, 6 years; in 1 case, 7 years; in 3 cases, 8 to 9 years; in 5, between 9 and 10 years; in 6, between 10 and 11 years; in 14,

between 11 and 12 years; in 54, between 12 and 13 years. Labor was easy in 22 cases; normal in 5 cases; difficult in 9; instrumental in 5; complications were present in 8 cases; 14 infants and 3 mothers died during delivery. Of 27 infants, whose sex was mentioned, 13 were males and 14 females. Of 37 infants, 20 weighed over 7 pounds at birth.

*Discussion.*—DR. SMITH ELY JELLIFFE said that it might not be malapropos to say something of Pellizzi's syndrome of precocious genital development, particularly in relation to defective pineal activity since the speaker had raised the question of its possible relationship to hypopituitarism from hydrops of the infundibulum. In a series of reported cases with Dr. Bailey on pineal tumors, they had referred the adiposis so frequently seen in the pineal syndrome—Froehlich cases—to the hydrops of the infundibulum and the cutting off of the nerve pathways to and from the hypophysis as they traversed the hypophyseal stalk. This interference with vegetative stimuli to or from the hypophysis was probably the cause of the faulty metabolic disturbance. The precocious sexual development, however, was a different affair and probably, as Marburg had suggested early, a pure pineal syndrome. Pellizzi had erected his syndrome, however, solely on clinical grounds. He had no autopsy material. He later, through the work of Foa and Sarteschi in his laboratory, sought to give it an experimental foundation. Dr. Jelliffe referred to the recent work of Boehme (*Frankfurter Zeitschrift für Pathologie*, Vol. 22, 1919), who had recapitulated the evidence concerning pineal deficiency and early sexual maturity, and had furthermore described some entirely new findings which if further corroborated would be of considerable interest. In a teratoma of the pineal gland with precocious sexual development, he had observed cells closely resembling the interstitial testicular cells of Leydig. These, if functioning early, might either directly or through gonadal interaction, be held to be the responsible factor in the sexual precocious development.

## THE NEW YORK ACADEMY OF MEDICINE.

### SECTION ON PEDIATRICS.\*

*Stated Meeting, Held January 13, 1921.*

MINER C. HILL, M.D., *in the chair.*

\*The program of the evening was arranged in conjunction with the Babies' Welfare Federation for the New York Nutrition Council.

CARE OF PRE-SCHOOL AGE CHILDREN AT THE COMMUNITY HOUSE  
OF THE ASSOCIATION FOR IMPROVING THE CON-  
DITION OF THE POOR.

MR. JOHN C. GEBHART stated that about 3 years ago the Association for Improving the Condition of the Poor decided that if it were to make an effective contribution to the growth of child welfare work there were 3 things upon which they would have to concentrate their efforts. These were: (1) Pre-natal care for the expectant mother; (2) examination and supervision of pre-school children, and (3) supervision of mothers in the home. To ascertain conditions among pre-school children, a survey was begun, first in a colored district, and then in an Italian district, choosing the district bounded by Houston and Canal Streets and Broadway. This district had a population of 32,335, of which 92 per cent. were Italians. In this locality there were about 1,400 persons to the block, exclusive of those who merely came to business there. This population was alien. Of the men, 75 per cent. were unnaturalized, and of the women, 65 per cent. were illiterate. From April, 1919, to October, 1920, Dr. Schroeder examined 2,186 children in this district, 894 of whom were of pre-school age. They had been particularly fortunate in being able to present so many children from the same neighborhood, the same racial stock, and often a number in the same family. The attempt was made to make a list of defects that should conform to other examinations of similar groups, but it was found that hardly any 2 investigators agreed as to what defects should be considered. They finally made a list of the main subdivisions of defects, omitting the insignificant ones. The statistical results were tabulated and showed in a general way that the greatest number of defects were those of the nose and throat; defects in nutrition ranked second; teeth, third; orthopedic defects, fourth; defects of the glands, fifth; and defects of the abdomen, sixth. In the group of pre-school children, 2,231 defects were discovered, or an average of  $2\frac{1}{2}$  defects per child; in the group of children from 6 to 12 years of age the average number of defects also numbered  $2\frac{1}{2}$  per child, while in the group from 12 to 16 years of age, the average was 1.8 defects per child. The whole number of defects meant little unless one knew their significance. Defects of the head were much higher in the first group than in

the other groups, but these defects were mostly due to rickets and disappeared as the child grew older. There was little difference in the percentage of eye defects in the different groups. Thirty-four per cent. of the entire series had nose or throat defects. Operation for the removal of hypertrophied tonsils was advised less often in the pre-school group than in the other groups. Of the pre-school children, 28 per cent. had defective teeth, while 96 per cent. of the children of school age had defective teeth. Defects of the lungs did not bulk large in this series; when such defects were found the children were referred to the tuberculosis clinics. Cardiac defects differed from some others in that the number of children showing such defect increased as the age of the children advanced. In the first group, 4 per cent. had cardiac defects, while in the second and third groups, 6 per cent. had such defects. This was a high percentage as the number of cardiac defects in similar groups was usually about 2 per cent. Among the pre-school children, 55 per cent. of the cardiac defects were functional. The percentage of undernourished children was about the same for the first two groups. The dental work, and eye, ear, nose and throat work was cared for by the schools in the usual way. Little could be done for orthopedic defects except to take such children to an orthopedic dispensary. Of the pre-school children, 24.6 per cent. had orthopedic defects. Most orthopedic defects were found to be due to rickets and plans were being made to prevent this kind of defect. Cardiac defects were cared for in the cardiac class at Bellevue. The public health work, carried out as one of the activities of the Mulberry Community House had met with a ready response on the part of the people. The question of dealing with undernutrition in the pre-school child had been a difficult one. It had been found that a weekly weighing in the presence of the mother was a very effective lesson in driving home the importance of fresh air, proper food, and rest. They were using a portable scale that the visiting nurse could easily carry with her. This statistical study was merely a by-product of the work; the main object was to carry public health education to these people and to teach the need for supervision of the child of pre-school age.

#### THE PRE-SCHOOL CHILD.

DR. MARK S. REUBEN asserted that the problem of the pre-school child deserved more attention than it received at present.

Children under 5 years of age constituted nearly 12 per cent. of the population; in this 12 per cent. of the population occurred 21 per cent. of all deaths in this country. In the registration area of the United States (1918), out of a total of 1,471,367 deaths, 306,143 were children under 5 years of age. The younger the pre-school child, the less apt was it to survive the fifth year. In children under 5 but over one year of age, the most important causes of death were the infectious diseases, respiratory diseases, intestinal disturbances, accidents and injuries, tuberculosis, diseases of the nervous system and of the circulatory system. The predisposing causes of mortality and morbidity at this age were the same as those encountered in the study of infant mortality. They were poverty, ignorance and neglect. The importance of adequate family income, of domestic economy and of hygienic surroundings and sanitary homes could not be over-emphasized. Education, like charity, should begin at home. Hereditary diseases should be treated in parents before children were born. There was a higher mortality among illegitimate children. Where the proper indications were present, the physician should advise women how to prevent conception. This did not mean that the advice should be given by women of deficient mentality and of doubtful sincerity.

The problem which the child under 2 years presented was somewhat different from that of the pre-school child; whereas with the former we were more concerned with reducing the death rate, in the latter our main efforts should be directed to prevent disease. The relation of the pre-school age problem to that of the school age was the same as that of pre-natal work to the reduction of mortality from congenital causes; to reduce mortality and morbidity of school children we must not neglect those of pre-school age. It was most important that minor diseases should receive attention at this age.

A summary of the methods which Dr. Reuben suggested for the reduction of mortality and morbidity at this age is as follows: 1. Complete registration of births; accurate statistics as to number and distribution of children. 2. Complete physical and mental examination of all children of pre-school age. 3. Constant observation, periodic examination, supervision of diet and home conditions, and correction of all defects. Special health

centers and schools. 4. Reliable standards as to height and weight of children of this age must be established. 5. Health education is the fundamental need of the day. Education is the panacea for ignorance. Academic colleges should provide information on health matters to their pupils; school teachers should receive similar instruction. Women should be especially trained for public health work. There should be a differentiation of public health nurses. The nurse should treat the sick; the public health worker should teach how to prevent the development of disease and how to maintain health. All school children should receive elementary instruction in diet and hygiene, and the formation of good health habits should be stimulated. All medical students should receive adequate instruction in diet, hygiene and public health work. 6. Permanent institutional care should be discouraged; all day nurseries and babies boarded out should be under strict medical supervision. 7. Playgrounds and play-centers should be established (7,000 children die every year from accidents and injuries). 8. Adequate wages, sanitary housing, and economical use of incomes are essential requirements. 9. The importance of attending to minor ailments must be emphasized. 10. To reduce morbidity and mortality from infectious diseases, precautions must be taken against the spread of these diseases. The younger the child the worse the prognosis and the more likely it is to have complications. Our precautions against pertussis are inadequate. The importance of vaccinating against diphtheria (with toxin-antitoxin) those who are not immune, as shown by the Schick test, and against smallpox should be emphasized. 11. To avoid respiratory diseases, boarding must be avoided; sanitary homes are essential. Rickets, infectious diseases and adenoids predispose to respiratory disease. Direct contact with those infected must be avoided. Therefore, proper feeding, proper hygienic surroundings, and proper clothing are essential; we must remove adenoids, and avoid all contact with patients who are suffering from any infection. 12. Digestive disturbances are often the result of improper feeding during the first 2 years of life. Breast feeding should always be encouraged. A quart of milk every day for every child should be insisted upon as the basis of a rational diet. 13. The child of tubercular parents should be removed from the focus of infection (preventoria).



The luetic parent should be treated before the mother conceives, during pregnancy and in fact after the birth of the child. 14. Cardiac diseases can be reduced by greater attention to the infectious diseases and avoidance and removal of all focal infections in tonsils, teeth and sinuses. 15. The great majority of cases of malnutrition is due to adequate causes such as physical defects, improper food, habits and over-fatigue and only in a minor degree is it due to poverty, inheritance and other obscure causes. 16. Proper diet and dental hygiene are the answer to dental caries. The wholesale removal of teeth in children for inadequate causes should be discouraged; filling, when possible, should be preferred to removal. 17. Diseased tonsils and adenoids should be removed. 18. The deformed (physically and mentally) and the delinquent child should receive special care.

STANDARD AND METHOD FOR HEALTH WORK AMONG CHILDREN  
OF PRE-SCHOOL AGE.

DR. ROBERT D. CURTIS stated that the need for continued supervision of children beyond the age of infancy had been convincingly presented and he felt that there was no question on this point. The important thing was to devise a workable scheme of putting it into effect. There was no source to which one could go for information as how to establish such work. Small beginnings had been made, it was true, but many links were as yet imperfect. The period of childhood following weaning was a very dangerous one, for at this time one had not only the problems of feeding but new problems having to do with environment. As soon as the child began to get about and to derive its food from various sources it was exposed to infection in many ways and was influenced by many conditions in its environment. Anything that affected the family for good or evil had a corresponding effect upon the child. A realization of the need for child welfare work had brought many agencies into the field. The danger of overlapping work by these various organizations had been greatly lessened by the Confidential Exchange, which aimed to correlate different child welfare activities. It seemed too much to expect the domestic mother to realize the need for continued supervision of the child after it had passed beyond the period of infancy. Mothers, as a rule, never felt competent to rely upon their own judgment where an infant was concerned, but when it

came to the older child she seemed not to question her ability to assume the responsibility, and seldom asked advice except for some very obvious defect. If conferences for pre-school children were to be well attended, means must be devised to get the parents to bring the children. Under an ideal system, all the children in a pre-school conference would come as graduates of the infant welfare station. The infant welfare conference offered the greatest opportunity for educating the mothers. All charitable and social agencies should join hands to educate the parents to the need of supervision for older children. Dr. Curtis said he felt that medical men and social workers would see the need of supervision for the pre-school age, but he felt they would not make an appeal to most mothers if they confined themselves purely to dealing with defects such as tonsils and adenoids, and the repair of dental defects, but he thought that if they added vaccination, postural work and dental hygiene these would make an appeal. Faulty posture was seldom given the attention it deserved and postural work might be considered as preventive medicine. With the establishment of dental hygiene and postural instruction, the parents would be given something they would appreciate. After mothers were convinced that this work was desirable, it still remained to convince the children as well. If the conference was not made attractive to the child, he would not care to come and the mother would yield to his inclination to stay away. In order to make an appeal to the child, a story-teller and books were provided and perhaps a sand box. It was necessary to have a separate room for the examinations. It was a rather strange thing that mothers did not object to having the defects of their babies pointed out before others, but disliked to have their older children exposed to view unless they were unusually well formed. The success of these conferences depended almost entirely upon the personality of the physician and other workers. A pleasant relation must be maintained with both children and mothers. For the physician, accustomed to think in terms of dietetics, anatomy and medicine, and at the same time keep himself on the child's mental level was a rather difficult task to perform. By keeping on the child's mental level, he did not mean having recourse to buffoonery, but maintaining a sympathetic and approachable attitude. The physical examination was relatively more important than other features. The well child should be examined once in three

months; those below normal as often as was necessary. In Boston, college students, taking household economics and those taking kindergarten courses, volunteered as assistants, the latter acting as story-tellers. A doctor, an able nurse and a dietetician formed an essential part of the staff. After infancy, the work of supervising children increased in amount at a surprising rate. Neither a nurse nor a dietetician was exactly fitted to do the work; they should have to find a plan to secure persons who had a broader training than either a dietetician or a nurse. The usual defects found in children of school age were also found in those of pre-school age. Tuberculosis at this age, however, was very rare. For those cases that were tuberculous, a tuberculosis expert should be available. The treatment of conditions of the nasopharynx was one of the most important parts of this work. There had been a good deal of criticism on the ground that tonsillectomies were performed. He was sure the number of harmless tonsils removed far exceeded the number of diseased ones left in place. Deformities of bones, spine and joints in the majority of cases were the results of rickets and malnutrition. These defects did not exist in children who had been under supervision from infancy. Dental caries was by far the most frequent defect in children of all ages. The supervision of children of pre-school age would insure proper care of the first teeth and would preserve them in good condition until the second permanent teeth came in. Malnutrition was an expression of disease that disappeared when the conditions producing it were corrected. The pre-school care of children should provide for the care of those with tuberculosis, for attention to the ears, nose and throat; it should provide for orthopedic, dental and nutritional work. Even with the care of all these departments, a child might remain subnormal, and in such children a complete change of environment was important. Every plan of supervision should provide opportunities for education in mental hygiene by directing play, teaching discipline and preparing the child for beginning work later on. Most communities had arrangements for the care of infectious diseases. Measles, scarlet fever and diphtheria were cared for in hospitals. Whooping cough, which caused more deaths than any one of the other diseases, was not cared for in hospitals, was spread by child carriers, and was allowed to go untreated. If the reports regarding

the value of pertussis vaccine continued to be confirmed, it should be made available in clinics. The maximum number of children that could be properly supervised by one worker was 175 and she would have 35 new children each year, while 35 would graduate from her care. He would give to each worker a group of children of fairly equal age-distribution, as the procedure to be followed with older groups of children was different from the established procedure for infants, since, in addition to problems of hygiene, those of environment and gaining the coöperation of the mother and child entered in.

*Discussion.*—DR. CHARLES HENDEE SMITH said the papers of the evening had brought out a tremendous number of things in regard to the care and observation of children of pre-school age. One might talk indefinitely on any one of them. One thing that had impressed him most of all was the necessity of continuous observation of children from infancy up. This meant that the cases must be classified or grouped first. It had been proven time and again that results obtained in any group were directly in proportion to the effort expended. This had been shown in malnutrition, cardiac and feeding classes and was equally true for the pre-school children. This fact was so obvious that it needed no reiteration, but the question before them was the way in which to attack it. It meant a tremendous number of pre-school clinics. It was not a problem similar to that of malnutrition or cardiac disease in which only a certain percentage of children were involved, but all children from 2 to 6 years of age must be observed. This meant, first, that the hospitals and dispensaries must separate pre-school children from older children and the child must be automatically graduated from the infant group to the pre-school group. If a child did not return for observation, he must be followed up, not only by the doctor, but a follow-up of the family must be carried out, as far as possible, within the limitations of their staffs by social agencies. Such a plan had been in operation at Bellevue for 2 or 3 years. At this age the cases of intercurrent illness (cold or sore throat, etc.), occurred so often that the mother came for treatment of each child several times a year without much follow-up work. Vaccination, Dr. Smith said, was a part of medical responsibility, and, if properly assumed, it helped to rivet the affection of the family on the hospital or clinic.

It was interesting to see a meeting of this kind and size talking about common diet habits and hygiene, and to realize the large number of people trying to advance the new methods of teaching mothers these matters. A few years ago, these would scarcely have been considered medical subjects. It was encouraging to see the change of heart that had come over people in the last 10 years.

DR. MINER C. HILL stated that in the Bowling Green Neighborhood Association the mothers were at first unwilling to bring their children to the Health Center for examination when they were apparently well. They were anxious, however, to have their children vaccinated and by holding out vaccination as an inducement they were able to draw a large number of children to the Health Center, where a physical examination was obtained before the child was vaccinated.

MR. GEORGE R. BEDINGER, of the New York Chapter of the American Red Cross, said he had been in the field such a short time that he could add but little to the discussion. In the work they had begun, they were appealing very strongly for the pre-school child, and he hoped that as time passed and their work developed, it could be extended into this field. At the present time, the Red Cross stations were situated near public schools, settlement houses, or neighborhood centers, and in connection with them there were dental and nutritional clinics, and the needs of the younger children were recognized. From the infant welfare clinic at Greenwich House, a child could be passed on to the supervision of their nutritional clinic and dental hygiene clinic and there could be referred to a pediatrician. The problem of the pre-school child had been recognized for a number of years and a great deal of praise should be given to the hospitals, the A. I. C. P. Community House, the Bowling Green Association and others, who really had done something in this field.

DR. HENRY DWIGHT CHAPIN stated that he happened to be a member of the Governor's Reconstruction Commission and Chairman of the Health Section, and had taken a great deal of interest in trying to find out the mortality and morbidity in different parts of the state, particularly in regard to the child. He had found that the pre-school child was the neglected child. He had sent out a questionnaire and the replies showed that in 29 communities,

with 48 infant welfare stations and 7 pre-natal clinics, there were only 5 clinics for pre-school children. In 34 municipalities, there were 6 pre-school clinics. In New York City, there were 83 welfare stations that did little for the pre-school child. There were 116 child welfare stations at 67 points in the up-state area. These might do something for the pre-school child. Dr. Chapin said he could not altogether agree with Dr. Smith about going back and beginning from the public schools. He thought we should work forward from the infant welfare stations. This work could be extended. It was already organized and in the field; they had places and the work could be extended to include the pre-school age. This seemed a comparatively easy way to enlarge the work of the infant welfare stations already in existence and doing such good work. Dr. Chapin stated that he had recommended to the Governor that health centers be established, since, in the up-state sections, attention to disease was often very inadequate. If we had health centers, it would solve many problems, but particularly the problem of the pre-school child.

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VACCINE IN PROPHYLAXIS AND TREATMENT OF WHOOPING COUGH (Policlinico, Rome, Sept. 20, 1920). L. Spolverini cites 408 cases of whooping cough reported by 8 different clinicians in which vaccine treatment was tried with excellent results in a large proportion, but adds a record of over 100 cases reported by 7 others in which no benefit was apparent. He describes the technic for the vaccine he has been using in 98 children with pertussis and in 46 others to whom it was given for prophylactic purposes. He refers further to 119 other children treated by 3 other clinicians with the same vaccine. When it was injected during the first ten days, during the catarrhal stage of the disease, marked improvement was the rule, the spasms becoming attenuated and disappearing. In a few instances brilliant results were obtained also at an advanced stage, but in the majority of cases, after transient improvement, the symptoms returned as pronounced as before. His experience suggests that the Bordet-Gengou bacillus starts the disease and opens the portals to other bacteria but the latter by the end of the third week crowd out the former, and hence a Bordet-Gengou vaccine is useless after that date.—*Journal A. M. A.*

# ARCHIVES OF PEDIATRICS

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## ORIGINAL COMMUNICATIONS

### CHILDREN'S DISEASES: A RETROSPECT

BY SIR ARCHIBALD GARROD, M.D., F.R.C.P.

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Those of us, whose student days date back to 40 years ago, have lived through a time of transition and progress unequalled in the previous history of the science and art of medicine. Yet from month to month, and year to year, we have so adapted ourselves to new ideas and methods, have so changed our outlook as our science grew, that we have scarcely recognized what was happening. Only when we look backward and compare the medicine of today with medicine as it was when we entered upon its study, is it brought home to us how immense has been the advance in the study and treatment of disease. Bacteriology and the study of metabolism have transformed our conceptions of

the nature, causation and effects of disease; new and more exact diagnostic methods, coupled with diligent application of the older methods, have greatly increased our powers of diagnosis, and, side by side with these gains, there has been a corresponding advance in therapeutics. The therapeutic gains may be summed up briefly under the headings of more fresh air, more thorough rest, more scientific feeding and fewer drugs.

Many drugs, previously esteemed, have fallen into disuse, and those upon which we still rely are administered with far clearer knowledge of their modes of action, and of the limits of their utility. The newer plans of treatment are mainly based upon bacteriological research, such as the employment of sera and vaccines, or take the form of various kinds of physiotherapy.

The help afforded by laboratory methods, both in diagnosis and treatment, can hardly be overestimated, but they have in no way lessened the need of clinical study. In the laboratory, we can study the agents of disease, and some of their effects upon the invaded organism, but it is in the wards that we must study the patients, and their individual responses to the therapeutic measures which we employ. We must not overlook the fact that the patient is at least as important as his disease.

In the general advance of medicine, the study and care of sick children has shared to the full. Children's hospitals have been established in all parts of our own and other countries, and in most general hospitals there are children's wards or out-patient departments, wherein the students may learn the special features and treatments of the maladies of childhood.

Undoubtedly pediatrics may justly claim to rank as a subject for special study, for, apart from the existence of maladies peculiar to childhood, the child impresses its special stamp upon maladies which attack adults also. A particular symptom will often suggest quite a different diagnosis according as the patient is a child or an adult, and that unconscious reasoning, which is a product of experience, follows quite different paths in the mind of the medical attendant. In order to become at all efficient in this branch of medicine, a man needs to be familiar with such differences and to apply in diagnosis and treatment that floating knowledge which is in the atmosphere of a children's hospital. On the other hand, specialism carried too far is greatly to be



deprecated in this field, in which the age of the patient is the sole dividing line from general medicine.

The aspect of the wards of children's hospitals has undergone a great change in these recent years. Tents and curtains have almost disappeared, and open windows at all seasons supply the fresh air and free ventilation which lend such powerful aid to treatment, and do much to limit the spread of infectious complaints introduced accidentally.

In the feeding of children, also, great advances have been made. Infant centres, instruction to mothers, and the care of the health of school children, have accomplished much, and promise to accomplish more, towards removing the gross errors of upbringing which were so common in our fathers' days, and are still far too common. Following Nature's guidance, we endeavour to supply to infants, who must be fed artificially, as good a substitute for human milk as circumstances allow. This has led to accurate or approximate regulation of the proportions of the various constituents, and to the prevention of formation of massive curd by citration or other means.

In recent years, we have learned that adequate calorie-value, and correct percentages of fat, carbohydrate and protein are not all that are needed, but that there are food constituents which find no place in such reckonings, small, indeed, in quantity but of immense importance, and which are easily destroyed. Indeed, the very care which we take in the treatment of the milk may damage it by destruction of the vitamins. At present, we know so little about these vitamins that we are driven to classify them, not by their chemical nature, but by their solubility in water or fat. Their absence gives rise to maladies, such as scurvy and rickets, which, resulting as they do from loss of such constituents of the diet, are aptly styled deficiency diseases. This serves to explain much that was hitherto obscure in connection with such diseases, for, long before the idea of vitamins had taken shape, experience had taught us that fresh vegetable and animal foods or juices supply the preventives and cure of scurvy, and that cod liver oil is of value in the treatment of rickets. Future generations should reap the full benefit from the new knowledge and guidance in such matters. Cleanliness of the milk supply is a matter of no less importance, and the first line of defence of our children from disease is in the cow-house, milking shed and dairy.

The danger of the conveyance of tubercle bacilli and other pathogenic bacteria by milk renders imperative the greatest care as to the sources of supply, cleanliness and handling of milk, and the employment of means of disinfection which avoid, as far as possible, the destruction of vitamins.

It is along such lines that we may hope to compass the prevention or limitation of infant diarrhoea, a disease responsible for much infant mortality, a better knowledge of the origin of which has led to great advances in its treatment.

It is a fact which is brought home to all workers in children's hospitals that, leaving aside the exanthemata, 3 pathogenic organisms are responsible for the bulk of the cases which fill their wards, namely the tubercle bacillus, the pneumococcus and the organism of rheumatic fever. Each of these produces in children different effects from those to which they give rise in adults, as witness the predominance of bronchopneumonia in children, of lobar pneumonia in adults, the frequency of tuberculous peritonitis and meningitis in children and the relative infrequency of pulmonary phthisis. Rheumatic fever presents widely different clinical pictures in childhood and adult life respectively. Whereas in children the articular lesions are wont to be trifling, the danger of cardiac lesions is very great, and such manifestations as chorea and nodules are practically confined to the period of childhood. This is a matter of which the due recognition is of extreme importance to the community.

One of the saddest features of work in children's hospitals is the frequency of grave cases of cardiac disease which is preventable, at least to some extent. How much home care may do is evident from the relative rarity of such cases among the children of the better-to-do. The trouble often dates from a rheumatic attack which almost escaped notice, so apparently trifling was it, and experience teaches us how much of the serious effect of such an attack may be averted by rest and care at the earliest stage of the trouble. Hence the education of parents as to the immense importance of care of any febrile illness, which may possibly be rheumatic, is a matter of urgent moment.

Much has been learnt, in recent years, concerning the earliest indications of rheumatic cardiac lesions. The dilatation, to which the late Dr. D. B. Lees called attention, often precedes, and is

even of more importance than the murmur at the heart's apex, systolic or mid-diastolic, which is the earliest sign of endocarditis.

This offers only a single example of the general advance in the early recognition of maladies, at a stage when there is the best prospect of success in their treatment. The earlier detection of pulmonary tuberculosis in adults supplies another example, and we recognize that the clinical pictures described in our text-books apply as a rule to the more advanced stages of diseases which may often be recognized whilst, as yet, there is but little departure from normality.

Infantile scurvy is a case in point. Nowadays we rarely meet with the advanced cases which were so well described by Barlow, Cheadle and others, since the most gross errors of infant feeding are less common than they used to be, but slight cases, with little more than tenderness of the limbs, and, if teeth have been cut, with some redness and swelling of the gums, are not uncommon and yield readily to appropriate dietetic treatment. Such mild scorbutic signs may even result from excessive care in feeding, from sterilization of milk without the precaution of replacing the destroyed vitamine. The same is true of rickets, which we may hope to see abolished, as a result of increased knowledge and better education of mothers in the care of their children.

Arrest of growth, partial or complete, may result from many causes. Any chronic disease in a child may bring such arrest in its train. Thus we see children who, in stature and development, fall behind their fellows because they are suffering from chronic pulmonary fibrosis, heart disease, congenital or acquired, granular kidneys or the malady known as the coeliac complaint. We believe that such disturbances of growth have their origin in upsetting of the normal balance of the endocrine glands, which, by their interaction, regulate the body processes. Although the first steps in our knowledge of these glands dates back to the days of Addison, Graves, Basedow and Caleb Parry, it is only in recent years that any adequate conception has been reached of their far-reaching influence, and of the fact that they constitute a system of organs, linked together and acting under the control of the sympathetic nervous system, in concert with, or in antagonism to each other.

Of diseases in which the thyroid gland is specially involved,

whereas exophthalmic goitre is rare in children, various degrees of hyperthyroidism are not uncommon, and sporadic cretinism is a condition of special importance, because it is amenable to treatment. It is an immense gain to the cretin if his condition is diagnosed at the earliest possible moment, and if treatment be commenced without delay. Whereas an adult sufferer from myxœdema will relapse if treatment by thyroid extract be discontinued, resumption of treatment will undo the mischief, in the case of a cretin time lost during the years in which active growth and development should be in progress can never be made good, and treatment begun at a later period cannot undo the stunting of growth and mental development which are such conspicuous effects of the thyroid defect. On the other hand, a cretin who receives continuous treatment from infancy may grow in mind and stature like a normal child.

Another malady which owes its origin to kindred causes is abnormal obesity, which is by no means rare in children. Several of the endocrine glands, including the gonads, have shares in the regulation of fat metabolism and deposition. The fat pads of the cretin bear witness to the part played by the thyroid in this connection, as also does the emaciation of some sufferers from Graves' disease. Obesity is one of the leading signs of Frölich's syndrome, which results from pituitary defect, and there is a rare, but well recognized, variety of obesity in children which is associated with adenoma of the adrenal cortex. Again, infantilism, in its various forms, is doubtless due to disturbances of function of the ductless glands. There are grounds for the belief that diabetes insipidus, and even diabetes mellitus, have such an origin, and we can hardly doubt that the changes attendant upon puberty bear witness to a readjustment, at that period of life, of the endocrine balance.

Diabetes mellitus is by no means rare in children, and side by side with the general advance which has been made, in recent years, in the study and treatment of that disease, there has been acquired a better understanding of the forms met with in early life. Although the specially grave prognosis which has been attached to diabetes in children is, in the majority of cases, fully justified, it has become apparent that there are cases, and cases of more than one variety, for which it does not hold good. In some

instances, a glycosuria which dates from early childhood, if not from birth, may persist into adult life, without any apparent detriment to health. Sometimes the amount of sugar in the urine is small, and the blood sugar normal or below the normal in amount, but in others, apparently no more grave, the percentage and daily output of sugar in the urine is by no means small, but the general health remains unimpaired, at least for a number of years, apart from any dietetic treatment. Much more work needs to be done on this subject before we can speak with confidence as to the ultimate fate of the patients so affected, or of the differences in the pathology of such "diabetes innocens" and that of the graver and more familiar types of the malady. The matter is one of real practical importance, because it may be better to leave the patient with the innocent form without any drastic restriction of diet, whereas one must be careful lest we omit to treat a patient in the initial stage of ordinary diabetes on the assumption that his disease is of the innocent variety.

The modern plan of treatment by restriction of intake not of carbohydrate alone but also of proteins and fats, is as applicable, in the main to children as to adults, and it is far less difficult than might be supposed to institute fasting days.

Malignant growths in children have their peculiar features. The comparative frequency of renal sarcoma in young children has long been recognized and malignant hypernephroma, which also is not uncommon, is wont to present clinical pictures which differ according as the right or left adrenal is the seat of the growth. The picture associated with left hypernephroma, first described by Robert Hutchison, can often be recognized some time before a tumor can be felt in the abdomen. The hæmorrhages into the upper eyelids and exophthalmos, in the absence of other signs of infantile scurvy, and the tumors upon the skull, can hardly be mistaken unless for that very rare disease chloroma and between these two conditions the blood count affords a clear means of differentiation.

The information supplied by examination of the blood is as valuable an aid in the diagnosis of disease in children as in adults. The leukæmias are comparatively rare in children, but the lymphatic less so than the myelocytic form. The pseudo-leukæmia infantum of von Jaksch shows a striking blood picture, features of which are the presence of myelocytes and of nucleated red

corpuscles, often in considerable numbers. Reference should also be made to the polcythæmia rubra, which is a conspicuous feature in cases of deep cyanosis resulting from congenital heart disease.

Delayed coagulation of the blood is now recognized as the underlying cause of the hæmorrhages of individuals with hæmophilia, and it is highly probable that the condition is due to a congenital enzyme defect. In this remarkable hereditary anomaly, treatment by normal serum has proved valuable, and Vines has shown recently that by repeated intradermal injections of minute quantities of horse serum, at suitable intervals, the effect may be prolonged and the coagulation time maintained at a level approaching the normal, over considerable periods.

Nor would it be easy to exaggerate the value of Wassermann's test in demonstrating the part played by congenital syphilis in the causation of disease in childhood, as witness the confirmation of the belief held before the test was discovered, that paroxysmal hæmoglobinuria is a manifestation of that disease.

To the clinical acumen of John Thomson we owe the recognition of 3 maladies of children previously unrecognized. Congenital stridor, which he first described and explained, is the least important of these, although it is important to know that symptoms so alarming are attended with little danger to life. The remaining 2 now claim much attention from workers in diseases of children.

One of these is pyloric stenosis, not uncommon in male babies, but rare in females, and giving rise to symptoms so characteristic that one wonders that their import was so long overlooked. Two distinct plans of treatment of this very fatal malady have now had extended trials, spread over a number of years. Some have relied upon carefully regulated feeding and daily lavage of the stomach, whereas others have advocated surgical measures. Recoveries on the former plan are few, and not infrequently come too late, when the intestine has lost its powers of assimilation before food reaches it in any quantity. Not a few, who were formerly advocates of the so-called medical treatment, have come to believe that the infant has the best chance of recovery if operated upon by a surgeon well versed in the technique of operations of this kind, at a relatively early stage, before its nutrition has become too gravely impaired. The cause of the

pyloric hypertrophy is still a subject of controversy, and opinion is widely divided between pyloric spasm as the provoking cause, and congenital malformation. Either explanation is beset with obvious difficulties.

The remaining malady is infection of the urinary tract by bacillus coli. It is common at all periods of childhood, especially in girls, may be slight or severe, and in some cases proves fatal. In the early stages, there may be considerable constitutional disturbance, and one familiar with the condition may suspect its presence from the general clinical picture, before pus or even albumin, can be detected in the child's urine. It should always be thought of as a possible cause of obscure febrile complaints in children.

The disease is very intractable, although much modified by treatment in most cases, and the kidneys may be riddled by miliary abscesses in a case in which it appears that good progress is being made. In some cases, treatment by alkalies yields the best results, whereas others respond better to the administration of urotropin. Experiences differ as to the efficacy or otherwise of vaccines. As to the path of infection, in spite of the special incidence upon the female sex, with its special liability to infection of the urinary tract from without, it is most probable that the path is intra-abdominal, from colon to urinary tract.

Of the exanthemata, although they figure so largely among diseases of childhood, not much need be written in this article. The years which we are considering have witnessed changes of type among such diseases, and this has been specially marked in the case of scarlet fever, which has become a far less grave malady in recent years. There has been an increasing realization of the serious havoc which measles works amongst the children of the community, and its enormous contribution to child mortality. Together with this has come a better appreciation of the importance of ample air-space and free ventilation in diminishing the dangers of such diseases and in reducing the risk of complications, both primary and secondary. The effect of such conditions in the prevention and treatment of tuberculosis calls for no emphasis at the present day, although what is common knowledge in medical circles still needs to be brought home to large classes of the community.

Among infectious diseases, diphtheria is that in which the greatest therapeutic advance has been achieved. Those of us, who were familiar with the picture of that malady before the use of antidiphtheritic serum, are best able to appreciate the change which has been wrought.

Much has been accomplished also by local treatment of the throat and nasopharynx, the parts which are specially liable to become seats of local complications of infectious diseases, and due recognition of the dangers inherent in aural infection, coupled with the advance of aural surgery, has led to the saving of many lives.

Among diseases which involve the joints, tuberculous hip-disease has lost some of its terrors. Insistence upon complete rest of the affected joint in the earlier stages, and earlier surgical intervention in cases in which operation is called for, have accomplished much, and it is one of the minor triumphs of modern surgery that lardaceous disease is hardly ever seen by the student of to-day. The multiple crippling affections of joints, the infective origin of which is no longer doubted, but of which our knowledge still leaves much to be desired, are among the less common maladies of children. It was Still who first called attention to the special features of these affections in children, and the frequent enlargement of the spleen and lymphatic glands. Opinions differ as to whether the so-called Still's disease is a distinct malady or no, for the nature of the infecting organism or organisms is still unknown, and the results of treatment are as little encouraging in children as in adults.

The acute arthritis of the hip of infants has been shown to be due to pneumococcal infection, and among rare forms of arthritis in children the meningococcal calls for mention.

In no branch of pediatrics has advance been more conspicuous than in the study of nervous diseases, both functional and organic. The intimate connection of chorea with rheumatic fever has been fully established, although there still are some who are not prepared to admit that rheumatic infection is its only cause. It is realized that the chorea syndrome includes much more than the incoördinate movement, and that among the symptoms of chorea, emotional disturbances, mania or dementia, asthenia and even paralysis, have to be included. In some cases the mental, in other



the asthenic, and in others again the motor symptoms dominate the clinical picture. It is now accepted that the cardiac lesions, which accompany chorea in so large a proportion of cases, are collateral rheumatic manifestations.

The danger of cardiac failure, due to endocarditis, in cases of diphtheria, is far better recognized than it used to be, and the necessity of absolute rest for patients suffering from that disease, and especially of such as exhibit loss of knee-jerks or more pronounced paralytic symptoms.

The method of lumbar puncture, and examination of the cerebrospinal fluid obtained by its means, have helped very greatly the study of the various forms of meningitis from which children suffer. Thus we are able to distinguish cases of true meningitis from others in which similar signs and symptoms are present, apart from any organic lesion of the meninges, a condition usually spoken of as meningism. Still's demonstration of the presence, in cases of post-basal meningitis, of an organism closely resembling, if not identical with the meningococcus, was the outcome of post-mortem work, but since the introduction of lumbar puncture, the finding of these organisms in the cerebrospinal fluid renders easy the diagnosis of the disease.

Even in tuberculous meningitis, a highly skilled observer can demonstrate the presence of the tubercle bacillus in a large proportion of the cases, but, short of this, the high pressure of the cerebrospinal fluid, its clearness and the presence in it of excess of lymphocytes, may serve to clinch an otherwise doubtful diagnosis, although a diagnosis of that form of meningitis may almost always be reached by purely clinical methods.

Our ideas regarding infantile paralysis have become greatly modified in recent years. The knowledge acquired of its epidemic occurrence, and the wide differences in signs and symptoms exhibited in cases which form part of a single epidemic outbreak, have made it easier to realize the liability of the grey matter of the brain to suffer with or in place of that of the spinal cord, and to diagnose polioencephalitis and encephalo-myelitis in children whose signs and symptoms would not, in former times, have suggested such a diagnosis. Better knowledge of the disease has, here or elsewhere, brought in its train improvement in methods of treatment, and we may hope that modern methods of support

and immobilization of the paralyzed limbs, and relaxation of strain upon the muscles, will serve to avert much of the crippling, which is so serious a sequel of this disease.

We have gained much fresh knowledge of the various forms of muscular dystrophy, but here unfortunately there has been no corresponding therapeutic advance.

In such an article as this, one can but skim the surface of a large subject, and select a few outstanding examples to illustrate the theme. Another writer would doubtless have selected a different set of examples, which would tell the same tale of progress. Yet the results achieved seem small when we reflect how much remains to be done, and whilst we rejoice in the successes of the past, they should but serve as stimuli to further efforts in the future.

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OBESITY IN CHILDREN (Lyon Médical, Nov. 10, 1920). G. Mouriquand warns to be on the alert to detect incipient obesity in the children of the obese, the diabetic, and the arthritic or gouty. When the mother is glycemic the fetus, floating in an actual sugar syrup, may become obese, and this entails dystocia. Experience has demonstrated that with early, inherited obesity nearly all develop diabetes before 40, but only about 50 per cent. when the inherited obesity does not develop till late, and only 15 per cent. when the obesity is acquired. After puberty, if the obesity declines, the outlook is favorable, at least to 35 or 40. But if the endocrine glands show insufficiency, progressive dystrophy may be anticipated. Obesity in the parents should be combated; especially during pregnancy the diet should be supervised. Overfeeding and sedentary habits in the family may render it necessary to remove the child to another environment where he will be stimulated to physical exercise. Organotherapy is indicated in certain cases. For example, a girl at puberty threatened with the adiposogenital syndrome may be given thyroid, ovarian and pituitary treatment in turn for ten days each, or the three may be combined. Or potassium iodid might be given for ten days each month (10 or 20 cg. daily).—*Journal A. M. A.*

## THE NATURE AND MANAGEMENT OF NEONATAL DISEASES

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It is well known that the age of an individual alters to some extent the characters of certain diseases from which he may be suffering, and it is also known that some maladies are almost limited in their incidence to certain decades in life; but the modification of symptoms in the one group of cases is generally slight and the age-limitation of the specific maladies in the other group is never quite exact. In other words, the effect of age upon the characters and nature of disease is, during the greater part of life, not arresting. It is quite otherwise with the diseases of the new-born infant, by which one means the morbid conditions which are developed during the first 4 weeks of life. For the sake of brevity, they may be termed the neonatal diseases. These neonatal maladies are so profoundly influenced in their symptomatology by the age at which they occur that they have been, and still in some cases are, regarded as special morbid entities, as distinct from the diseases of other times in life as, say, scarlet fever is distinct from myxœdema. Their aloofness from other diseases is generally marked by the word "neonatorum," which is commonly placed after their names, and the scantiness of our knowledge of their real nature is often emphasized by the fact that their names are simply those of symptoms. Thus, there is icterus neonatorum, in which the second word points to peculiarities in the malady (jaundice), which warrant its separation from jaundice occurring at other times in life than the first month, whilst the first word (icterus) is obviously that of a symptom and gives the sharp reminder that our knowledge of what lies behind it is small. Many instances may be cited, but it will suffice to name melæna neonatorum, hæmoglobinuria neonatorum, tetanus neonatorum, mastitis neonatorum, ophthalmia neonatorum, omphalorrhagia neonatorum, cephalhæmatoma neonatorum, sepsis neonatorum, keratolysis neonatorum, sclerema neonatorum, and pemphigus neonatorum. Occasionally, the name of the neonatal malady is not that of a single symptom but of a complex of symptoms or a syndrome, such as cyanosis afebrilis icterica

cum hæmoglobinuria or Winckel's disease of the new-born. So far as their nomenclature is concerned, the diseases of the new-born seem to form a nosological group by themselves.

*Conditions Modifying Neonatal Diseases.* The attempt will be made in this communication to show that the neonatal maladies are not so decisively special in their nature as has often been thought; it will be suggested that the specificity of their characters is in many cases to be explained by the age at which the diseases develop and by the peculiarities of the anatomy and the physiology of the neonatal state and the environment then existing. Neonatal diseases are not special, but their manifestations have a special character by reason of the marked type of the life which they render morbid. They have often also been termed idiopathic; but the true explanation of their etiology probably is that the causes which produce them are those which produce disease at other times in life altered in their impact by the circumstances of the neonatal life. In other words, the striking differences shown by neonatal diseases and the apparent inexplicability of their causation are both the result of the new-born infant's unique personality, recent experiences, and present environment.

*Anatomical Considerations.* It is unnecessary to elaborate the self-evident fact that the anatomy of the neonatus is something *sui generis*. In his structure the new-born infant is neither a fetus nor a child; he is anatomically a fetus assuming infantile characters—he is a transition organism. Almost every one of his parts is on the way from one thing or state to another. The atelectatic lungs of antenatal life are expanding in the neonate into the fully-distended, air-containing organs of the child, and, in association with this wonder working transformation, far-reaching structural alterations are going on in such vessels as the ductus arteriosus, the ductus venosus, and the umbilical arteries and veins. The three-chambered heart of the fetus is changing into the four-chambered one of the child, and smaller modifications are taking place in the anatomy of the liver, the stomach, the intestines, and the kidneys. The neonate is neither the miniature of the boy nor the magnification of the fetus; he differs anatomically from both; the differences are deeper than mere size. Some parts of the body, as, for example, the cranium,

seem to retain fetal characters more persistently than others; and it hardly requires to be pointed out that the unclosed sutures and the open fontanelles of the head of the new-born modify cerebral diseases such as hydrocephalus and hæmorrhages very markedly. These anatomical differences should never be lost sight of when the physician is studying the diseases of neonatal life. The large size of the liver and the thymus are not without significance. These anatomical considerations have a still greater importance when the new-born infant is also a prematurely born one. He is then structurally a 7 or an 8 months fetus, and he will be nominally 2 months old before his anatomy is that of an ordinary neonate. In every part of his body this immature anatomy will be visible and its immaturity will affect all the diseases which may attack him. It is in part this condition which gives to some of the diseases of the new-born, premature child their peculiar characters; instances may be found especially in the cutaneous maladies such as sclerema, dermatitis exfoliativa, pemphigus, and icterus.

*Physiological Considerations.* If the anatomy of the neonate has a special bearing upon the manifestations of disease in him, and there can be little doubt that it has, then his physiology will have a still more fundamental effect. Here again one has to keep in mind that the physiology of neonatal life is a transition one; it is fetal physiology in process of alteration, readjustment, and modification in order that it may become infantile physiology. If it is remembered how different the life of the fetus is from that of the child, it will not be difficult to realize how deep-seated and essential are the changes which must of necessity occur in order that it may be changed into it. All these profound alterations are going on in the neonate. One has only to read the chapters on neonatal physiology in Dr. Feldman's book on Antenatal and Postnatal Child Physiology in order to conceive the magnitude of the influence which these alterations must have upon maladies developing in these critical days of early existence. The physiology of the blood is a case in point. Everyone knows that histologically fetal blood is very different from adult and infantile blood; but no one yet has discovered the subtle ways in which its biochemistry differs. In antenatal life, the blood is oxygenated and otherwise modified by coming into contiguity with maternal blood which carries oxygen and carbonic acid

and other things in solution or suspension; after birth, the interchanges are no longer between fluids but between fetal blood and atmospheric air; and in the new-born this extraordinary transformation in function is being accomplished. To say that the gearing of life is changed suddenly in the neonate is to use terms which are inadequate to express all that is going on. No wonder some of the diseases of the blood of the new-born are difficult of comprehension. Need there be surprise that mystery should surround such maladies as melæna neonatorum, and that Winckel's disease, Buhl's disease, Bar's *maladie bronzée*, and Parrot's *tubal-haématique rénale* should lie in a perfect jungle of etiological hypotheses? Jaundice of the new-born, if not usually so fatal as these other disorders, is not less puzzling in its causation. Dr. Ritter von Reuss, in his work on the Diseases of the New-born (of which an English translation has just appeared) is not going beyond sober truth when he says, "in view of the obscure etiology of hæmorrhagic diseases (of the neonate), a causal therapy does not lie within our power"; the remark may be almost as safely made about many of the diseases of neonatal life which are not hæmorrhagic. One cause of the etiological *impasse*, which Dr. Ritter von Reuss has to admit, is the absence of an adequate knowledge of neonatal physiology, and its absence is in turn the consequence of lack of knowledge of fetal physiology. One is thus constrained to allow that, even if the study of antenatal life and functions never saves alive a single fetus, it must yet be pursued in order to enable us to treat rationally the diseases of the neonate.

When the prematurely born infant is looked at, physiological considerations become still more clamant, for, if the functions of the mature newly-born infant show reminiscences of the life before birth, assuredly those of the prematurely born child exhibit an actual attempt on the part of the new-born to go forward with the functions of the fetus itself still in action. The premature infant is unable at once to replace the physiology of fetal existence with that of post-natal life. Hence many of the neonatal maladies, hence the appalling numbers of neonatal deaths, *hinc illæ lachrymæ*.

*Pathological Considerations.* A scrutiny of the anatomical and physiological peculiarities of the new-born infant prepares

the investigator for the discovery of manifest peculiarities in neonatal pathology, and his expectations are not disappointed. The new-born infant has, as a fetus, been liable to diseases and he may bring them with him into postnatal life, if they allow him a chance of surviving-birth (which is rare); but as a fetus there was interposed between him and pathogenic microbes his mother's body and especially his placenta as barriers against bacterial invasion; now, after birth he is much more at the mercy of the germs of disease, and their avenue of access to him is extended from one portal (the umbilicus) to several (mouth, nose, throat, skin, etc.). These facts have a marked bearing upon pathology. No doubt there will be peculiarities in the onslaught and effect of microbes upon such virgin soil, so to say, as the tissues of the neonate, but the evaluation of these peculiarities is not fully within our reach at present. It is possible, however, to recognize special characters in some neonatal maladies as due to the antenatal avenue of access for germs (the umbilical) which persists for a short time in the mature new-born infant and for a longer time in the premature one. Microorganisms of various kinds, including those of sepsis and tetanus, may find their way into the body of the neonate through the umbilicus. If they pass up by the umbilical vein, they will at once reach the liver; if downwards, by the umbilical (or hypogastric) arteries, they will arrive in the tissues between the umbilicus and the symphysis pubis. In the former case, a particularly fatal variety of jaundice of the new-born, depending on septic hepatitis, will develop; in the latter, erysipelas neonatorum, affecting the subumbilical region and the scrotum, finds its cause and its explanation. When the falling off of the cord is associated with persistent patency of the umbilical vessels, as in the premature infant, such an umbilical invasion is specially liable to occur. Recurrent jaundice in successive children of the same parents is sometimes ascribed to more or less mysterious hereditary influences, but it is not unfrequently simply the manifestation of septic hepatitis due to persistent lack of aseptic precautions in the treatment of the umbilical cord. The disease known as tetanus neonatorum was for long regarded as a malady of a peculiar kind, occurring only in the new-born infant; but it is now known to be simply tetanus of the ordinary sort due, however, to the arrival of the tetanus bacillus in the body of the new-

born by the typical antenatal avenue, the umbilical. If the umbilicus be kept germ-free, tetanus neonatorum disappears.

Some of the diseases of the neonate are due to microbic infection before the life after birth has begun. A well known instance of this is found in ophthalmia neonatorum in which the gonococcus finds access to the fetal conjunctival sacs during the transit of the child's head through the infected vaginal canal of the gonorrhœal mother. Immediate cleansing of the eyes at birth may prevent the development of this disease, so dangerous to sight, and preliminary treatment of the gonorrhœal vaginitis in pregnancy may act with still greater certainty. Is it likely that gonorrhœal conjunctivitis is the only malady which the child may acquire in its passage through the birth canals? The writer has little doubt that it will be discovered that many other microbic maladies owe their origin to intranatal infection. The fact that deaths occur in infants of 24 or 36 hours, in which the necropsy reveals advanced pneumonia with swarms of streptococci in the lungs, suggests infection of the lungs before birth. When it is discovered, as is often the case, that in these births there has been early rupture of the fetal membranes rendering the access of germs to the nose and throat of the unborn infant an easy thing, it is not difficult to accept the theory of intranatal invasion of the child's lungs. Possibly other neonatal maladies may have an origin of the same kind at the same time; possibly, also, the anus may serve occasionally for the entrance of pathogenic microbes. The conclusion is, therefore, arrived at easily that aseptic midwifery, from the standpoint of the prevention of neonatal maladies, gains an increased importance, and that early rupture of the membranes is of ill omen. Certain of the diseases of the neonate owe their peculiar characters to the fact that they are really fetal diseases which have appeared in antenatal life. The protected and semi-parasitic life before birth permits such maladies to reach extraordinary degrees of severity, and thus it comes about that neonates may suffer from such diseases as ichthyosis and dropsy and ascites in grossly exaggerated forms. So exaggerated are these maladies, when they occur at birth, that they have been looked upon as new things altogether, and have been given special names such as "harlequin fetus" and elephantiasis congenita to mark their sui-



generisity (to coin a much needed word). It is not, of course, denied that there may be diseases which are absolutely peculiar to neonatal life, never occurring at any other age; but it is maintained, that before any disease be admitted to this group, it should be rigorously scrutinized lest it turn out to be merely a disease common to other ages in life so modified in appearance and severity as to seem to be novel.

There is another way in which neonatal maladies take on special characters: the state of the mother may inhibit the appearance of the ordinary symptoms and signs of some diseases, such as syphilis in the new-born infant, leading to the apparent latency of these disorders for a few weeks after birth. There is still great mystery about the fact that ordinary syphilitic manifestations are often long delayed in their appearance in the first months of life, and into this difficult question the writer does not propose to enter; but he would suggest, as a possibility, that syphilis may then show itself in other ways, e. g., in the extraordinary tendency that exists to the occurrence of hæmorrhages in the internal organs, such as the brain, the spinal cord, the suprarenal capsules, and liver. Neonatal syphilis, when it does occur, is well known to have characters which are special to it; but it may well be that the full measure of their specificity has not yet been realized.

Finally, the pathology of the neonatal maladies is affected by the existence of malformations, external but more especially internal, which have developed early in antenatal life, but have had comparatively little influence upon fetal health. The changed circumstances, in and after birth, enable them to become pathogenic and in many cases lethal. A double hare-lip and cleft palate may only slightly interfere with the nutrition of the infant before birth but the neonate is seriously encumbered by this anomaly, his diseases may take on special characters on account of it, and his death be speedily accomplished by it.

*Special Characters of Neonatal Diseases.* If the writer has been successful in his presentation of the characters of neonatal life, it is not difficult to see why neonatal maladies are so hard to classify and to understand, why their etiology is so obscure, and why their mortality is so high, and their morbidity so great. They are ordinary, not extraordinary, diseases, but they occur in an organism which is extraordinary in the sense that it is a

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transition one and so they come to have peculiar characters and a special mortality. The new-born infant is the meeting place of antenatal morbid tendencies with postnatal pathological causes and lesions, and these diverse influences all fall upon a body which has just passed through the unique experience of birth. In him we see microbic and toxic and toxinic agencies getting to work upon an organism which has been curiously preserved hitherto from all such assaults; his body is more or less *terra incognita* to these invaders, and one is or ought to be prepared for strange happenings.

*Management of Neonatal Maladies.* From all that has been stated in the preceding paragraphs, one is not surprised to find that the management of many neonatal maladies has been and still is singularly ineffective. The dread with which most doctors approach a neonatal malady is explicable; they know that the mortality of such diseases is high, they feel a lack of knowledge of the conditions of the life of the new-born infant, and they search in vain for clear guidance either in the oral and clinical teaching or in the literature of the subject. It is obvious that this is a department of medicine in which much work has to be done as a primary requisite for the attainment of rational success. There are 4 directions in which progress is possible and desirable.

*Directions of Future Progress.* In the first place, there is abundant room for *research*; indeed such research is an essential preliminary to all further success in neonatal practice. Since the life before birth has so profound an influence upon that which immediately follows birth, it is clear that it will richly repay investigation. There are many who think that antenatal anatomy and physiology are rather outside practical medicine, but a little reflection shows that this is not so, for they underlie and penetrate the anatomy and physiology of neonatal life, giving it many of its distinguishing features, and no one denies that the knowledge of this life is essential for the understanding of the diseases which are then met with. It may, of course, be long before great progress is made with the management of diseases before birth, but for the help that it will give in the management of those which follow birth it is well worth while to study very closely both antenatal anatomy and physiology. It goes without saying that

neonatal structure and function call urgently for research, if one would understand neonatal pathology and the nature, causation, and treatment of neonatal disease. Every neonatal death should, if possible, be followed by a thorough post-mortem investigation. The clinician has in the past been strangely pre-occupied with the search for the causes and mode of death of individuals passing in a ripe age out of life; he must in the future give more thought to the investigation of the fatalities which happen to the infants just coming into life. Research laboratories are badly needed in connection with every maternity hospital.

In the second place, far more attention must be given to the *teaching* of neonatal disease and health. It may be objected that clear and precise directions cannot be given on these subjects; but surely that is an argument for the study of them, not for the neglect of them. Each course of teaching on obstetrics ought to be reinforced by instruction on neonatal maladies and their treatment; and the examining bodies ought to demand certificates of such studies. There are far more neonatal lives lost in connection with child-birth than maternal ones.

In the third place, the *hospitalization* of the new-born infant is in many places a real necessity. Every maternity hospital should have its neonatal department for the care and treatment of the delicate, the premature, and the diseased neonate. Details of construction, of elaboration, and of administration call for thought, inventiveness, and, above all, for patience and persistence, but success in the management of neonatal disease and in the prevention of neonatal death is well worth striving for. The humanitarian millionaire has here his great opportunity in these days.

In the fourth place, there is need for *specialization* in neonatal medicine, and this applies to doctors and to nurses as well as to the teaching of the subject and the construction of hospitals. The specialist in neonatal diseases and the nurse intensively trained and expert in the management of delicate new-borns will be commonplace ere long; but they are hardly known at present. Rewards await them when the public and the profession have awakened to the extreme desirability of saving neonatal lives and preserving neonatal health. In the meantime, they will have for encouragement the opportunity of accomplishing much for the welfare of the people, of reducing much sickness

and suffering among the most helpless members of the population, and of, at the same time, investigating a most interesting department of medical practice. Great advances have been made in recent years in reducing infantile mortality between the ages of 1 and 12 months; but what may be called the *neonatal bloc* remains largely untouched, the number of deaths per 1,000 live births in the first month of life being as high as ever.

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TREMOR IN CHILDREN (Nederlandsch Tijdschrift v. Geneeskunde, Amsterdam, Sept. 11, 1920). Schippers emphasizes the information to be derived from this rare symptom in children. When it occurs alone it may give the clue to incipient meningitis or other disease of the central nervous system so that the advisability of lumbar puncture should always be suggested with acutely developing tremor in a child. In the first of his five cases, two boys of 6 and 8 and their sister, 14, presented a hereditary, familial tremor. In two other cases infants about a year old presented the acute cerebral slow tremor with wide excursions in neck and limbs; it persisted during sleep, and was exaggerated by excitement. Sometimes it is restricted to one side or to the arm or leg, and there may be spastic phenomena, paresis or ataxia. In 1916 18 cases had been published, but it is probably of more frequent occurrence, as Schippers' two cases and De Lange's two at Amsterdam seem to show. This tremor was always preceded by pneumonia, measles or enteritis, but it subsided in from 2 to 12 weeks; one case is on record in which the child grew up feeble-minded. In Schippers' fourth case the tremor was the first symptom to call attention to sporadic meningitis. In his fifth case the year old infant presented tremor in the arms when excited, and as it seemed sick, lumbar puncture was done, which confirmed the assumption of pressure on the brain. The child soon died with symptoms of meningitis, and necropsy revealed hydrocephalus with suppuration in the ventricles. Tremor as an early and single sign of meningitis is rare, but Göppert has reported a case in an infant of 11 months with vomiting, spasm and fever, and tremor of head and arms with wide excursions. Necropsy revealed epidemic meningitis. The monosymptomatic tremors in children are thus highly instructive.—*Journal A. M. A.*

## DIET AS A FACTOR IN THE CAUSE OF RICKETS.

BY LEONARD FINDLAY, M.D., D. SC.

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At the present moment, there is great discussion between 2 schools of workers regarding the part played by diet in the cause of rickets. The one school holds that this disease is chiefly, if not wholly, due to a dietetic error, to the absence of some essential element, a vitamine, while the other school considers that the disease is related to defective hygiene, using this term in its broadest sense. Personally, I would be inclined to narrow the cause down to confinement and lack of exercise, and in support of this view I wish to bring forward some interesting therapeutic results.

The vitamine theory is certainly seductive, and to-day is the most popular one, but it owes its acceptance in great part to its novelty, though the prevalence for many years of a general idea that rickets is a dietetic disease has also materially helped. In this connection, it is only necessary to refer to Bland-Sutton's oft-quoted experiments with lion cubs in the London Zoological Gardens, the teaching of Cheadle, and the current opinions expressed in our text books.

It is always interesting, if not advisable, in the case of any question, which is *sub judice*, to review as a whole the evidence extant, and in the case of the present question, i. e., the etiology of rickets, we have a goodly volume of experimental and clinical material well worthy of consideration.

The first attempt to induce rickets experimentally by a modification of the diet was made by Weiske<sup>1</sup>, who was followed shortly afterwards by Voit<sup>2</sup>. Both these authors fed young animals on a calcium-poor diet, and they affirmed that in this way they were able to produce rickets. This aspect of the dietetic question, viz:—deficient intake of calcium, held the field for many years, but, with the increase in our knowledge regarding the histology of the disease, it became apparent that in reality merely an osteoporosis was produced, and not a condition simulating true spontaneous rickets.

Hopkins<sup>3</sup>, in 1906, suggested that rickets might be of the nature of a deficiency disease, an idea which was resuscitated by

Funk<sup>4</sup>, in 1913, and still later by Mellanby<sup>5</sup>, in 1918, in a short communication which he made to the Physiological Society. Mellanby expressed the opinion that rickets is due to the absence of an accessory food factor which he believed to be associated with fat and meat extracts, and was probably identical with the fat-soluble A substance. At the same time, he stated that confinement and lack of exercise only played a subsidiary part in the etiology.

This new view appealed to many physiologists, and was accepted by the Vitamine Committee of the Medical Research Committee<sup>6</sup>, who, in their report on accessory food factors, refer to Mellanby's work at great length, and state that, "though incomplete, the results are sufficiently definite to place rickets among the deficiency diseases." They also publish 2 lists of food-stuffs, one of which, poor in fat-soluble A, allowing the development of rickets, and another, rich in fat-soluble A, preventing the development of the disease. It is unfortunate that such definite statements were made so early, and before the experimental details were available, for not only have the workers themselves recanted from their previous statements, but the unqualified approval of a body, such as the Medical Research Committee, must give any statement in the minds of the medical profession at large an authoritative importance.

The suggestion that food was related to the cause of rickets was especially interesting, recalling as it did, the work and teaching of Bland-Sutton<sup>7</sup> of many years previously, work which has considerably influenced British thought on the question. Bland-Sutton's experiments were prophylactic in nature and analogous to the recent important tests of Hess and Unger<sup>8</sup> of New York with negro children.

Bland-Sutton has kindly supplied me with details of his experiences with rickets in young carnivora in the London Zoological Gardens, experiences which have been extensively quoted in the medical literature, but which were never published in detail by him. His attention had been drawn to the difficulty of rearing young carnivora in confinement. They "were often born with cleft palate, and those that survived soon developed rickets." To remedy these things, he advised that the adult lions should be given goat flesh and bones twice weekly instead of

being fed entirely on horse flesh (the bones of horses being very hard), and that the young be given cod liver oil to lick. As a result of these changes in diet, some of the lion whelps were born without cleft palate, and others, which grew up to adult life, presented remarkable rickety changes in their skulls. Such experiments do not justify the conclusions regarding the influence of fat in rickets that have been based on them by his disciples, and I know that within recent years Bland-Sutton has held the opinion that a gastrointestinal disturbance, probably of a microbic nature, is the initial cause of the disease.

Mellanby's work therefore seemed to give Bland-Sutton's view a new significance. His first more or less detailed communication was published in 1919.<sup>9</sup> Unfortunately, Mellanby does not describe the experiments which enabled him to negative confinement as a contributory factor. He states that by means of certain diets, in which fat and meat extractives were presented in small amounts, rickets developed, permitting him to conclude that "rickets is a deficiency disease, which develops in consequence of the absence of some accessory food factor or factors." As this factor, he incriminated the fat-soluble A. At this date, he admitted that exercise might play a part in delaying or preventing the onset of the disease, but due to consequent increased metabolism and liberation of the fat-soluble A factor, stored in the body's fat depots.

During the following year (1920) Mellanby<sup>10</sup> made a further communication on the subject, restating his main thesis, that rickets is a deficiency disease, but complicating the issue by reference to the protein and carbohydrate contents of the diet, protein acting as an inhibitor and carbohydrate as an exciting factor. This is almost a complete reversion to the clinical teaching of Cheadle with the proviso, that the fat does not act as fat, but as the repository or carrier of the fat-soluble A vitamine. In this communication he admits that the ultimate explanation of rickets must also embrace exercise.

Hopkins,<sup>11</sup> at the annual meeting of the British Medical Association at Cambridge in June, 1920, reaffirmed his conviction that experimental rickets, at least, is a dietetic disease, though in November of the same year, during the course of a lecture on "Recent Advance in Science,"<sup>12</sup> while referring to the fat-

soluble A vitamine, does not discuss rickets, as he admits that "many points are at issue."

The possibility of fat being in some way associated with the disease has always been borne in mind by the Glasgow School. In 1906, when I first attempted to induce rickets experimentally, I did so on the advice of Bland-Sutton by means of a fat-poor diet. These experiments were intended primarily for the study of the condition of the blood in rickets, and in no way with a search after the etiology. Marasmus and not rickets, however, was the result, whereas the control animals, fed on whole milk, developed the disease. It was during these early experiments that the idea of confinement and lack of exercise being the cause of the disease was developed, an idea which obtained support when I became acquainted with the previously recorded work of Von Hanseemann.<sup>13</sup>

In 1911-12, when Miss Lindsay,<sup>14</sup> under the direction of Noël Paton, conducted a dietary study of the labouring classes in Glasgow, the question of whether the rachitic families consumed less fat per individual than the non-rachitic families was considered, but no definite conclusion could be reached. The same point was specially studied by Miss Ferguson in her investigation of the economic and dietetic factors in rickets,<sup>15</sup> and again the result did not justify one in incriminating fat as a factor of prime importance in the cause of the disease. The same fact emerged from these 2 sets of dietary studies, viz:—that the general condition of the home, as evidenced by the amount of air space per individual and cleanliness, was decidedly inferior in the case of the rachitic families.

Paton, Findlay and Watson<sup>16</sup> carried out a further series of experiments in young animals with a fat-poor diet, and the findings were definitely opposed to the idea of fat playing a part in the cause of the disease. Two litters of pups were used—a certain number of each litter were fed on whole milk and kept in the laboratory, while the others were reared in the country on a diet of skim milk. Those kept in the laboratory and fed on whole milk developed rickets, while those brought up in the country on skim milk remained free from any manifestation of the disease. Noël Paton and Watson have just completed another set of experiments on somewhat similar lines but guaranteeing an adequate caloric supply. The diets consisted of whole milk



and bread, separated milk and bread, separated milk, lard and bread, and of the 17 animals only 1 of them fed on separated milk and bread, showed any signs of the disease.

Here then are 2 sets of experimental workers, apparently carrying out comparable experiments, and yet obtaining very divergent results. It is a pity that some means of bringing them together could not be found so that the error, for some error there must be, under which one of the groups is labouring, could be discovered. Such divergent results, however, only speak for the urgent need for further work on the subject.

From the clinical point of view, there is also a considerable amount of material relating to various aspects of the question. There are in the first place the dietary studies previously mentioned. One must admit that such dietary studies are not conclusive evidence of the amount of fat that any one individual child ingests, a criticism which both the Medical Research Committee and Mellanby have raised against these communications. Yet Mellanby, in both his papers on the question, attempts to substantiate his arguments by general reference to the diets, habits and customs of different races and peoples. Hopkins, too, who was chairman of the Vitamine Committee, responsible for the Report on the Accessory Food Factors, stated during a discussion on vitamins at Cambridge<sup>11</sup> that "nearly 15 years ago he acquired a bias in favour of a dietetic factor by observing the disease in Venice, where it seemed so frequent in families which, so far as one could discover, never even saw dairy products of any kind." It is perhaps fortunate that his travels did not take him to the West Coast of Africa, where dairy products are probably more rare, and rickets unknown, or much of the interesting work emanating from Cambridge might have been denied us.

These dietary studies were merely considered one method of gaining information on this important question, but in the present discussion let us put them on one side and limit our attention to the non-contraversial clinical tests, which must after all be the acid test of any theory. These fall under 3 headings: (1) prophylactic; (2) provocative; (3) curative.

*1. Prophylactic Tests.*—A series of tests of this kind was carried out by Hess and Unger<sup>8</sup> upon the negro children of New

York. Negro children are notoriously prone to rickets when living under unnatural conditions in any city, and Hess, from a preliminary enquiry, found that practically 90 per cent. of such children presented evidence of the disease. To a certain number (32) of children, he administered from their earliest infancy varying doses of cod liver oil, and he states that among those who had been receiving the oil for at least 6 months the development of rickets was prevented in 93 per cent. of the cases. Crude cod liver oil, known to be rich in the fat-soluble A vitamine, was employed. In a certain number (10) of the cases, however, rickets was already present before the commencement of the treatment, in the other 6, the condition remained unchanged, and in 2, it progressed, which result does not appear to be an unqualified proof of the rickets-preventing power of cod liver oil.

That cod liver oil would seem, however, to possess a certain prophylactic power, I have satisfied myself from a similar set of experiments carried out in Glasgow by Miss Ferguson under my direction. In our series, there were 57 children varying in age between  $1\frac{1}{2}$  and 12 months, and the amount of cod liver oil administered was about 2 ounces per week, i. e., much the same amount as given by Hess. The cases were divided into 2 sets, 27 receiving oil, and 30 being used as controls; at the end of 6 months, the cases were examined by me with the following results.

	OILS	CONTROLS
Non-rachitic .....	23 = 85%	10 = 33%
Rachitic .....	3 = 11%	18 = 60%
Doubtful .....	1 = 4%	2 = 7%

These results, though demonstrating an apparently beneficial effect of cod liver oil, are not such as we would be led to expect from a comparison with scurvy, if rickets, like scurvy, is really a deficiency disease. Miss Ferguson distributed the oil herself and visited at periodic intervals the homes of the oil cases, so that there is the possibility that the consequent general supervision of the household in this way may have had a certain influence. It must, too, be the experience of all clinicians, and certainly it has been mine, that markedly rachitic children come under observation in whose diet the mother states cod liver oil has formed a constant constituent for prolonged periods.

2. *Provocative Experiments.*—These experiments were car-

ried out by Hess<sup>19</sup> in New York. They are strictly comparable to many of our animal experiments and undoubtedly form the most important addition to our knowledge of the question in the human subject within recent times. Acting on the assumption that the development of the disease is related to the absence of the fat-soluble A vitamine, Hess fed a series of children on a diet of adequate caloric value, but in which the fat present was of the vegetable variety and reputed to be poor in the fat-soluble A vitamine. Cotton-seed oil was the fat employed, a fat stated by the Medical Research Committee and the Cambridge School to be poor in this substance. As a result of this diet, however, Hess did not find any interference with the rate of growth of the children, or that they were more prone to the development of rickets than children fed in a normal fashion. He concluded that the absence of the fat-soluble A substance could not therefore be the cause of the disease, and expressed the opinion that the disease was more properly dependent on the caloric value of the diet than on the presence or absence of any one particular food stuff.

This apparently clean experiment has called forth from the upholders of the vitamine theory a curious line of criticism. Mellanby<sup>10</sup> has attempted to refute the significance of the findings by asserting that cotton-seed oil is one of the best of the poor-fat-soluble A fats, that the amount of casein in the milk contained a sufficiency of the fat-soluble A, and that the protein was in sufficient amount to exert its deterring influence. Hopkins,<sup>11</sup> on the other hand, through a misunderstanding regarding the amount of dried separated milk administered, held that it was given in such large quantities that it apparently contained the necessary amount of the fat-soluble A or anti-rachitic factor. Hopkins states that he has experimental proofs that highly separated milk does contain more fat-soluble A than can be accounted for by the amount of the residual fat present, and he raises the question of it being attached to the casein molecule.

In spite of those criticisms, however, the outstanding fact remains that children, fed on a diet stated to invariably cause rickets in growing pups, did not develop the disease.

3. *Curative Tests.*—Cod liver oil as a cure for rickets is almost a household word, and it is proclaimed as such in practically every text-book of medicine and pediatrics, but there have

been published, so far as I am aware, practically no detailed accounts of series of cases treated and cured in this way. Scattered throughout the literature can be found isolated instances of the supposed beneficial effect of cod liver oil on the calcium metabolism in rickets, but a very careful test recently carried out by Telfer in Glasgow, and communicated to the Physiological Society in January, 1921, gives no support to this view.

I only know of 2 records of systematic attempts to test the curative effect of cod liver oil. Rosenstern<sup>17</sup> treated a series of cases, using as the gauge of the effect of the drug, the rate of disappearance of the accompanying craniotabes, and he concluded that by the administration of cod liver oil alone, rickets could be materially benefited.

Recently there appeared a report by Dr. Helen Mackay<sup>18</sup> of a serious and well organized therapeutic experiment in cases attending a polyclinic. The treatment consisted in the addition to the diet of definite amounts of food-stuffs supposed to be rich or poor in the anti-rachitic substance (fat-soluble A). One series of cases was studied during the months of March, April and May, and was treated simply by the addition of moderate amounts of the different fats, e. g., butter, 2 drams daily; cod liver oil, 2 drams daily; and cotton-seed oil, 2 drams daily. Another series was investigated during July and August, and in them large amounts of cod liver oil equal to 6 drams daily for a child of one year, were given, but in this series the mothers received in addition, instructions regarding the general dieting of the children.

In the first series of cases, no apparent improvement could be detected, and curiously the children receiving the cotton-seed oil increased in weight more rapidly than those receiving either butter or cod liver oil.

In the second series, consisting of 18 children, the improvement was marked. The weight of the children increased more rapidly, in several there was improvement in the bone lesions, nevertheless in one child of  $1\frac{3}{4}$  years, receiving 6 drams of cod liver oil daily, the disease continued to advance. The author rightly admits that it is impossible to draw any definite conclusion from these latter experiments, conducted as they were during the summer, the season during which rickets shows a natural tendency to spontaneous recovery.

My own experience with cod liver oil has been somewhat similar to that of Miss Mackay, and even the addition of phosphorated oil has not, in my hands, been accompanied by any greater success. But by neglecting all dietetic and medicinal treatment, and concentrating attention on the general hygiene of the child, and giving directions towards diminishing the amount of confinement indoors and increasing muscular exercise, much better results have been obtained. This method of treatment was suggested by one's idea of the cause of the disease, and it was felt that the result of such treatment would substantiate or otherwise the theory.

In order to gain more reliable information on this point, and to definitely contrast the 2 methods of treatment (dietetic and exercise), I selected, by paying attention to age, degree of osseous deformity and ability or otherwise to stand and walk, 2 as similar sets of cases as possible. One set was admitted to hospital, where care was paid to the diet and medicinal treatment with cod liver oil and phosphorated oil instituted, while the corresponding cases were treated in the outdoor department by means of massage and electricity. In the latter cases, no injunctions were made regarding diet, and no drug was given. The cases were examined by me at the end of one month's treatment and compared with one another. The results are shown in the subjoined table and require no comment. I should state that the experiments were commenced by me, and continued by Dr. G. B. Fleming during my absence at Geneva. I have no definite theory regarding the *modus operandi* of this line of treatment, but in view of the want of definite evidence regarding the effect of fat, I consider the explanation of Mellanby, that its virtue lies in its power to liberate the fat-soluble A from the fat depots of the body, quite untenable.

## OIL CASES.

1. T. Bk. Æt. 5½ years.  
 Came under observation 2, 7, '19.  
 Extreme degree of rickets with  
 severe osseous deformities.  
 Was neither able to stand or  
 walk unsupported.

*Diets*:—Porridge and milk—mince  
 and potatoes—milk pudding—  
 bread and margarine—milk ad  
 lib.

*Medicinal treatment*:—Olei Phos.  
 min. 2½ and Olei Morrhuæ  
 drams 1, t. i. d.

## MASSAGE CASES.

2. J. Bm. Æt. 5½ years.  
 Came under observation 9, 7, '19.  
 Extreme degree of rickets with  
 severe osseous deformities. Was  
 neither able to stand or walk  
 alone and had never been able  
 to do so.

*Diet*:—Run of house—no change  
 in diet—given butter when  
 mother could afford it.

*Treatment*:—Massage and elec-  
 tricity with both galvanic and  
 faradic currents daily.

- 14, 7, '19, can stand alone.  
 17, 7, '19, trying to walk.  
 24, 7, '19, able to walk alone.

1, 8, '19, Two children compared.  
 J. Bm. can walk easily.  
 T. Bk. can only stand with sup-  
 port.

3. J. S. Æt. 3 years.  
 Came under observation 28, 6, '19.  
 Marked case of rickets—can only  
 stand with support.  
 Dietetic and medicinal treatment  
 same as Case No. 1.

4. M. L. Æt. 2 years.  
 Came under observation 9, 7, '19.  
 Marked case of rickets with bony  
 deformities. Can stand with  
 support but not walk.  
 Treatment with massage and elec-  
 tricity every alternate day. No  
 change in diet during experi-  
 ment.  
 16, 7, '19, can stand alone.  
 28, 7, '19, can walk alone.

1, 8, '19. Two children compared.  
 J. S. no improvement.  
 M. L. can walk alone.

OIL CASES (*Cont.*)

5. D. G. Æt. 2½ years.  
Came under observation 9, 2, '20, with severe rickets. From age of 9/12 years had been fed on general diet of household. Since age of 1 year has been able to stand with support but has never walked.  
Treatment as in Case No. 1 but in addition butter 3 times daily.

MASSAGE CASES (*Cont.*)

6. J. St. Æt. 3 years.  
Came under observation 9, 2, '20, with severe rickets. Can neither stand nor walk alone. This child was in habit of getting a certain amount of butter. Treatment by massage and electricity daily. No. change in diet.  
20, 2, '20, walked alone.

4, 3, '20. Two children compared.

J. St. can walk alone easily length of room.

D. G. can only walk with help and cannot stand alone.

7. J. Mc. C. Æt. 2 5/12 years.  
Came under observation 10, 1, '20 with severe rickets. At age of 15/12 years had influenza and had gone "off feet since." Can not stand without support.

Treatment same as No. 5, i. e., general diet with butter and Olei. Phos. min. 2½ and Olei Morrhue drams 1, t. i. d.

28, 1, '20. Child observed to be standing holding on to rail of cot today.

8. J. W. Æt. 3 years.

Came under observation 9, 2, '20, with severe rickets. Can stand with support, but can make no attempt at walking. This child had been in habit of getting butter in addition to a general diet, which was not altered during experiment.

Treatment by means of massage and electricity daily.

20, 1, '20, marked improvement—can walk with support.

28, 1, '20, walks alone.

5, 2, '20. Two children compared.

J. W. can walk length of room without help.

J. Mc. C. can only walk with much help.

I think that from the above survey of experimental and clinical material it is hardly justifiable, at least at the present moment, to place rickets definitely among the deficiency diseases, or to incriminate the fat-soluble A vitamine as the etiological factor. If rickets is a deficiency disease, then it behaves very differently to the other known diseases of this nature. No one for a moment doubts that scurvy is a disease of this type, but whether or not it is possible to detect any dietetic error, a cure can always speedily be obtained by presenting a food stuff known to contain the water-soluble A substance, unless in the most advanced stages with secondary septic infection. Contrast this with the behaviour of rickets. Not only have I said that from the histories of many examples of rickets cod liver oil has been found to form a regular constituent of the diet but, in both Hess's and in our own prophylactic tests, rickets continued to develop in spite of the administration of fat-soluble A, rich cod liver oil; and finally, as Dr. Mackay has shown, food stuffs rich in the fat-soluble A factor do not necessarily bring about a cure.

The supporters of the vitamine theory, as previously mentioned, criticise adversely any antagonistic piece of work. Their line of argument is invariably the same. If rickets has not developed, then the food stuffs of the diet must have contained the anti-rachitic vitamine, and, if rickets does develop, the anti-rachitic vitamine has been absent, whatever the nature of the diet. In fact, it would seem that according to them the cause of rickets is settled, and that all the experimental work is intended rather as a means of discovering in what food stuffs the fat-soluble A vitamine is or is not present.

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## CÆLIAC DISEASE.

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Although this affection was originally described by Gee, in 1888, as the "Cœliac Affection," and by Cheadle, in 1903, as "Achoia," and many clinical and pathological investigations into its characters and causation have been made on it since, it remains a mysterious and little understood clinical entity or symptom-complex. Gee's original description is admirable:—"There is a kind of chronic indigestion which is met with in persons of all ages, yet is especially apt to affect children between one and five years old. Signs of the disease are yielded by the fæces; being loose, not formed, but not watery; more bulky than the food taken would seem to account for; pale in colour, as if devoid of bile; yeasty, frothy, an appearance probably due to fermentation; stinking, stench often very great, the food having undergone putrefaction rather than concoction. The pale loose stool looks very much like oatmeal porridge or gruel. The hue is somewhat more yellow, otherwhile more drab. The paleness is commonly supposed to signify lack of bile; but the colour of the fæces is a very rough measure of the quantity of bile poured into the duodenum; nay, more, the colour of the fæces is a very rough measure of the quantity of bile which they contain. Whitish stools are not always so wanting in bile as they seem to be; in particular, opaque white food, such as milk curd, undigested, will hide the colour of much bile." Gee also described the pallor, wasting, tendency to dropsy and the stunting consequent on prolonged duration of the disorder.

Various writers have reported, as instances of this affection, cases which should be differentiated therefrom; more especially inflammatory diseases of the ileum and colon with the passage of loose stools and, possibly, a secondary cœliac disorder. These will be referred to in discussing the diagnosis. It is essential, therefore, to formulate a definite clinical picture of the complaint.

I think we must first of all distinguish between acholia and cœliac disease and realize clearly that acholia is a main feature

of cæliac disease, but that it can occur independently and without developing into the more serious affection.

*Acholia* may be simple in origin and temporary in duration. It is not "cæliac disease," though the passage of acholic stools may be the earliest indication of the onset of this affection. It occurs in catarrhal jaundice, i. e., catarrhal duodenitis with obstruction to the flow of bile into the duodenum, and not infrequently as a temporary incident in infancy.

Undernourished infants, fed on cow's milk, may pass white stools due to excess of undigested milk curd; and, as Gee pointed out in his description, such curd will hide the colour of much bile. These stools have neither the offensive smell due to absence of bile, nor the rancid odour caused by excess of fat. It is too readily assumed that white stools are due to acholia. In some instances, bile is present in another form, the bilirubin being converted into a colourless urobilinogen instead of into urobilin. Normally, bilirubin is converted into hydrobilirubin by the action of the pancreatic secretion, and then into urobilin. Urobilinogen is also derived from hydrobilirubin and forms a colourless compound in an alkaline medium. Hence, the presence of either urobilin or urobilinogen indicates the passage of bile into the duodenum and the absence of true acholia, although the stools are white if urobilinogen is present instead of urobilin.

According to the degree of deficiency or absence of bile in acholic stools, the colour varies from pale straw, clayish or dirty grey, like putty, porridge or oatmeal, up to the whiteness of white paint or pipe clay. The stools are acid or slightly alkaline; glistening, greasy and fatty; often frothy and very offensive, and much larger than normal, in consequence of deficient absorption.

These characteristics are due to deficiency or absence of bile, which can be determined by the tests for bilirubin, hydrobilirubin, urobilin and urobilinogen; and by the tests for bile salts, which are also absent in market cases.

*A Case of Cæliac Disease.*—As an illustration of this affection, I describe a typical case, a boy who was under my observation and investigation in hospital for 6 months. He was 3 years old on the date of admission; and for 2 years he had been passing 3 or 4 loose, offensive stools daily, and had developed marked abdominal distention. For the last year he had been treated in

a poor-law infirmary. He was very small, greatly emaciated, weighing only  $21\frac{1}{4}$  pounds and looking like a child of less than 2 years of age; rather pale, weak and listless; with a large, flabby, tympanitic belly; and passing large, loose, clay-coloured, very offensive stools. As usual, the emaciation was more marked in the limbs and trunk than in the face.

During the 6 months, his general condition varied from time to time and he showed a certain amount of improvement. He gained 4 pounds in weight; at times putting on weight rapidly and then for no apparent reason wasting with equal or greater rapidity. His muscular debility also varied, independently of his weight, and sometimes he would "go off his legs" completely and be unable to stand without assistance. His appetite was generally good. Occasionally, the stools exhibited a little colour, and frequently they became of the consistency of porridge and lost their offensive smell, but no formed stool was passed during the whole period.

*Pathological Reports.*—(1). A characteristic stool:—strongly acid, greyish and pasty; slightly rancid; small amount of mucus; no unrobinin, bile pigment or blood; no muscle fibres or starch granules; some undegenerated epithelial cells and vegetable fibres; several refractile fat globules and abundant crystalline needles of fatty acids. Solids, 21.3; water, 78.7 parts. Inorganic ash, 22.2 per cent. of the dried weight of fæces. Total fat, 44.4; neutral fat, 26.24; fatty acids and soaps, 18.18 per cent.

(2). Urine, normal:—the urinary diastase 32 units; a slight excess, the normal amount varying from 10.0 to 22.2 units; in pancreatic deficiency it reaches over 100 units.

(3). Blood:—hæmoglobin 62 per cent.; colour index 0.68. Number of red cells, 4,500,000 per c.mm.: megalocytes 12, microcytes 15 and poikilocytes 1 per cent.; slight polychromasia; excess of platelets. White cells 9,200: mononuclears 37.4 per cent. (small 36.2; large 1.2); and the remaining 62.6 per cent. consisting of polymorphonuclears 51, eosinophiles 2.2, mast cells 0.8, transitionals 8.6. There were no myelocytes. Thus, the blood examination showed nothing beyond an oligosideramia, such as is often present in children and accounts for the low colour index.

The conclusions derived from the pathological reports were:—

1. The blood changes were secondary; 2. The slight excess of

urinary diastase was only suggestive of a mild degree of pancreatic insufficiency, not enough to account for the disease; 3. The acid-content of the stools, the high organic acid, the high value for total fat and the relative ratio of unsplit to split fat were indicative of intestinal disturbance, and were similar to the changes usually found in cœliac disease; 4 The absence of urobilin indicated a lack of biliary secretion.

*Clinical Description.* These cases are so remarkably alike that it is unnecessary to give a description of more than one. Any differences which have been noted can be ascribed to complications, which will be described later.

The chief characteristic is a persistent or relapsing looseness of the bowels, not always sufficient to be called diarrhoea, usually 1 or 2 stools daily, with recurrent periods of 3 or 4 stools daily of the type already described and containing an excessive proportion of fat, in comparison with the amount taken in the food; occurring in an infant or young child with a large belly and a distinct retardation of growth and development, sometimes so marked as to deserve the name of "cœliac infantilism."

Such a child is pale and apathetic; remarkably emaciated in prolonged cases, especially in the limbs, whereas the face may remain comparatively plump as in cases of intestinal dyspepsia and abdominal tuberculosis. In addition, there is considerable muscular weakness and generally debility, at times so marked that the child cannot walk or even stand without assistance. At intervals, under treatment, there is noted both improvement in strength and gain in weight. One of the most striking features of a prolonged case is the small size of the child, who appears from 2 to 5 years younger than his real age. The mental development is normal, except in so far as it is somewhat backward, from lack of education and mixing with other children, on account of the illness. Possibly the general malnutrition interferes a little with the normal, or full development of the intellectual faculties.

For months or years the patient's health remains more or less stationary, periods of improvement being followed by periods of relapse, until death ensues from asthenia or intercurrent disease. In favourable cases, the periods of improvement become of longer duration, while the relapses are shorter and less severe,

until eventually steady improvement ends in recovery. It is not unusual for successful results to be ascribed to efficient dietetic treatment or some particular drug, but it is more probable that the cure depends on the gradual development of efficient digestive functions as the child gets older; provided that suitable dietetic and medical treatment are given in the meantime, for undoubtedly an injudicious diet is harmful and medical remedies are beneficial.

*Etiology.* There are 3 curious observations—facts if they are confirmed by further observations on a large number of cases—for which no certain explanation can be offered. Firstly, the affection is more frequent in private than in hospital practice. I have seen about an equal number of such cases in each class, but have seen a very much larger number of hospital patients. Still, in his Lumleian Lectures (1918), stated that he had seen 24 private and 17 hospital cases. Secondly, Still noted a much greater frequency in the female sex, 30 girls to 11 boys. Among my cases, however, I have not noted any marked preponderance of either sex. And, thirdly, it is a disease of early life, beginning under 5 years and generally under 2 years of age. Gee, in his description, states that “it is met with in persons of all ages,” but I am inclined to take the view that the supposed cases in older people, when the disease begins after 5 years of age, are of a different character, such as sprue, pancreatic disease, and various types of intestinal inflammation and ulceration.

The exciting cause and mode of onset are variable and often ill-defined. Most noteworthy, the disorder does not occur in the breast fed infants. Cheadle regarded dentition as an exciting cause. The disorder begins so often in the second year of life that its onset is apt to coincide with a dentition period, but I have no doubt that the teething is coincident, not causative.

No predisposing factor has been determined. It may start in the strong and healthy, though perhaps not as readily as in weak and delicate infants. In many instances, there is a history of constipation which is replaced by the passage of white stools, no longer formed and becoming persistently loose. More often there is an initial attack of diarrhoea and sometimes a slight degree of fever, suggestive of a primary infective ileocolitis and a secondary functional derangement of the digestive organs and

the secretory functions, the stools never having become formed since the beginning of the illness. But ileocolitis is a remarkably common disease, whereas the cæliac affection is infrequent.

The occurrence of a temporary acholia in infants is suggestive of a primary affection, which may become established as a permanent cæliac disease.

*Course.* As the disease progresses the child becomes irritable, fretful, languid, pale and flabby. The appetite is variable or poor, sometimes ravenous for a period and then more or less in abeyance for a time. Vomiting is not uncommon. The stools are of the nature already described and, in late stages, may contain mucus, blood and pus from secondary inflammation of the gut.

Additional symptoms may be found in prolonged cases. A form of chronic glossitis is not infrequent, with superficial ulcers. In an infant, brought from abroad, it was so pronounced and persistent as to suggest the possibility of sprue. The tongue became red and glazed.

Skin eruptions and purpura are sometimes noted, and scurvy may result from dietetic restrictions. Œdema and dropsy ensue from anæmia, debility and general impairment of nutrition.

Rickets is rare. It was noted in the long bones of a girl, aged 7 years, by Miller, Webster and Perkins (1920). The freedom of these cases from rachitic changes has been regarded as rather a remarkable fact and as an argument against the hypothesis that rickets is due to deficiency of the fat-soluble A vitamine, for the diet given to these patients contains little or no fat. It should, however, be remembered that deficient fat-absorption is very common in marasmic infants with intestinal derangement, that these infants have often to be fed on a diet containing very little fat, and yet they develop little or no evidence of rickets. Obvious rachitic changes are most marked in moderately well-nourished or fat infants, brought up on a diet containing an undue excess of carbohydrate food and an insufficiency of fat, though sometimes the diet contains a liberal supply of fat as well. This suggests that rickets is due to excess of carbohydrate foods, with or without a deficiency of fat, whereas a fat-poor diet alone produces marasmus. In cæliac disease, the fat in the diet has to be restricted, and almost invariably the carbohydrates have also to be

limited; so the absence of rachitic changes can be ascribed to the same causes as in marasmus.

*Diagnosis.* As a rule this is comparatively easy, if the affection is of some duration and if the stools are examined microscopically and chemically. Various affections exist in which the belly is markedly enlarged and the stools are loose and undigested. Herter described an affection of this character under the name of "toxæmic infantilism," and it is often referred to as "Herter's infantilism." He ascribed it to the replacement of the normal intestinal flora by the *b. bifidus* and *b. infantilis*. The clinical features were a large belly and the passage of stools which contained much fat, soap, fatty acids and mucus. Possibly some of the cases were cæliac disease, but the above bacilli are not found preponderating in this affection.

Abdominal tuberculosis can generally be differentiated by the doughy feel of the enlarged abdomen and, perhaps, the presence of tuberculous masses. If no such masses, or glands are palpable, and the case is of the ascitic type, with slight effusion of fluid, there is more risk of error. As a rule, loose stools are not common in abdominal tuberculosis, unless there is ulceration of the bowel. Examination of the stools will clear up a doubtful diagnosis. But it is in the very early stages of this affection that diagnosis is difficult, and often impossible. For instance, a boy 11 months old was brought up from the country to see me on account of sleeplessness. After careful examination I ascribed this to indigestion and unsuitable diet. Five weeks later he was again brought on account of the passage of clay-coloured stools, suggestive of disturbed liver function and acholia. The amount of milk in his diet had been reduced. The liver was greatly enlarged, reaching the level of the navel. I saw him in another 9 weeks and found the enlargement of the liver had subsided, and that 4 largish masses, undoubtedly tuberculous, were distributed across the upper part of the abdomen about the level of the navel. Since then these lumps have got gradually smaller and calcified. He is now a strong, healthy boy of 10 years.

Like tuberculous ulceration of the ileum and colon, dysentery may lead to error in diagnosis, if it is not thought of as a possible explanation of prolonged looseness of the bowels. Ulcerative colitis or ileocolitis, generally a sequel of an infective ileo-

colitis, presents even greater difficulty if the stools are not thoroughly examined. As an illustrative case, I may describe that of a girl, 26 months old, when I first saw her. She had been breast fed for a week and then brought up on cow's milk. At 11 months she had an attack of laryngospasm, followed by subsequent attacks on and off for 3 months. At 17 months of age, in October, she had an illness diagnosed as acute colitis. Since then there had been constant diarrhœa. On examination she was remarkably thin, with 16 teeth, an unduly red tongue and distended belly. The face had taken part in the emaciation, but was not as wasted as the trunk and limbs. Although on a starvation diet she was passing large, very offensive, loose stools, containing curds and mucus. The characters of the stools were suggestive of cœliac disease, a diagnosis previously made, but their appearance was more in favour of chronic colitis. On a more liberal diet she improved rapidly for a few days. Then she had a relapse and died from asthenia in another two weeks. Examination after death revealed 6 to 8 recent acute ulcers in the transverse colon and 1 in the lower ileum. Here and there, throughout the stomach and gut, were the scars of old ulcers. In view of these lesions, the case must be regarded as one of chronic ileocolitis of the ulcerative type, secondary to an acute attack, rather than one of cœliac disease with secondary ulceration. No doubt a chemical examination of the stools would have confirmed the diagnosis, but it was not deemed necessary. The prognosis was hopeless.

*Prognosis.* Except in the cases of temporary acholia, of comparative unimportance, the affection runs a slow and tedious course and lasts for months or years, producing marked lack of physical development. As a rule, it ends in recovery and the child gradually grows into a normal adult, but is apt to remain unduly small. It is said to be rarely fatal. Out of 41 cases (Still) only 6 died, and 2 of the deaths were due to accidental causes. Probably the death rate is higher than these figures suggest. Hospital patients cannot be kept indefinitely and are often lost sight of; so too private patients, if the disorder is very prolonged. Death is due to asthenia, following prolonged relapses; to secondary catarrhal inflammation of the gut; or to other complications.



*Pathogenesis.* Herein lies the crux of the matter. So far, no positive evidence of value has been discovered in the body after death. The liver is either normal or rather small. The spleen is sometimes enlarged. And secondary inflammatory changes have been found in the alimentary tract, chiefly in the small intestine.

At present I think we must regard the affection as a symptom-complex dependent on the failure of the biliary functions. The ascertained facts include a deficiency or absence of biliary secretion, intestinal derangement, and deficient absorption of food-stuffs, notably fats. Other explanations have been put forward and must be briefly referred to. Toxic absorption from the gut, or intestinal toxæmia, can be regarded as a secondary, but not a causative factor.

Forsyth (1919) suggested boric acid poisoning as the exciting cause, basing this hypothesis on the case of a girl, 8 months old, whose symptoms cleared up when a fresh milk supply was obtained. The previous milk contained 5 grains of boric acid to the pint. He pointed out that the use of boric acid as a preservative is a comparatively recent custom (*Lancet*, 1887), and that Gee's original paper was published in 1888; that boric acid may be legally added to cream and butter also; and that asses' milk, condensed and dried milk, to which no preservatives are added, are harmless. And he might have noted the absence of the disorder in breast fed infants. On the other hand, it is difficult to believe that the amount of acid, ingested in this way, is sufficient to set up such a serious affection. If it can, I should expect it to be much more common and more readily curable by the omission of milk from the diet. It might be argued that the boric acid sets up some intestinal irritation and that the celiac affection is secondary thereto. There is no pathological evidence of hepatic irritation.

A pancreatic defect, functional or organic, can be excluded on the following grounds: No abnormal structural change has been found after death and observations during life do not indicate a functional disturbance; the amount of urinary diastase is practically normal, and was only slightly raised in the typical case described; there is no true steatorrhœa, i. e., the passage of liquid, separated fat; there is no defective fat-splitting, no proteolysis and no creatorrhœa; Loewi's test is negative.

The conclusion arrived at is that the affection is due to a fail-

ure of fat assimilation or absorption of unknown causation or the result of hepatic inadequacy which causes a deficient secretion of bile, but no organic hepatic disease. No such disease has been found after death and organic disease of the liver does not cause the cœliac affection. Bile has considerable influence on the proper digestion of fat, and the stools show that the chief failure lies in the absorption and assimilation of fat. The percentage of fat in the stool of the case recorded was 44.4; in three of Still's patients, it was 26.9, 42.5 and 73.1 respectively (analyses by Cammidge); and in three, reported by Miller, Webster and Perkins, it was 57.14, 52.4 and 24-28, the last one being a quiescent case. Though we may ascribe the defective absorption to the lack of bile, we remain ignorant of the cause of this deficiency; and the administration of bile does not cure the patients.

*Treatment.* The diet must be reduced in quantity and altered in quality. Fat must be limited in amount and sometimes entirely excluded. In a quiescent case, it may be given in moderation. The large globules of cow's milk seem particularly unsuitable, so recourse must be had to human or asses' milk, or a dried, malted or condensed milk. If skimmed cow's milk is tried, it is advisable to partially predigest it by preparing it with Bengel's food. The fat in yolk of egg agrees well with some children; while others can often take small quantities of butter, bacon fat or beef dripping. Cream must be avoided entirely.

Carbohydrates agree best in the form of malted or partly malted preparations; rusks, malted rusks and biscuits all crumble up easily and are more digestible than bread, especially new bread. Milk-sugar, maltine and honey are useful additions to the diet, if the starches are not well digested. Sometimes potatoes agree well. Sometimes ground rice, semolina and revalenta can be taken.

For protein food, rely on good broths, and pounded-up fish, chicken or other white meat, and mutton or beef. Calves-foot and sweet jellies may also be given. The diet must be regulated in accordance with the digestive powers, and for this reason it is advisable that the amounts taken should be carefully estimated and the stools examined daily. The variability in the digestive powers of different patients for different articles of food is extraordinary.

Bile salts and bile have been given to remedy the deficiency and great expectations have been formed of their value, but they have not been fulfilled in my experience. Temporary improvement occurs in patients not taking these preparations as well as in those who do take them, and it remains uncertain whether they are really beneficial. I think they should be tried in all cases, because bile is deficient and bile salts encourage fat-splitting, possibly because of lessened peristalsis and greater fat absorption. Bile salts stimulate the secretion of bile, and observations should be made on these patients to ascertain if there is any increased secretion when bile salts are given. They can be given in the form of glycocholate and taurocholate of soda  $\bar{a}\bar{a}$  gr. i, with an alkali, syrup of orange and water. If the child is old enough, ox bile can be given in keratin-coated capsules. Possibly benefit might accrue from the administration of ox bile through a duodenal tube.

Bismuth and soda, and aromatic chalk powder are useful for the looseness of the stools; and sulphocarbolates, phenol or salol for the offensive smell; the salol may be combined with small doses of castor oil and given several times a day. Salicylates, ammonium chloride, tincture of podophyllin and brandy may be useful as hepatic stimulants; small doses of grey powder are often beneficial.

On the whole, treatment is still unsatisfactory and is likely to remain so, until we know more about this peculiar affection. It requires much further investigation and it is "up to" the specialists on disease in children to carry these investigations to a satisfactory issue. Probably the results of treatment would be better if the cases came under observation at an early date. Usually they are treated for months before the diagnosis is suggested, on the assumption that they are suffering from intestinal indigestion or "consumptive bowels."

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## ON CHRONIC INTUSSUSCEPTION IN CHILDREN.

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It may seem almost an impertinence for a physician to take as his theme an affection the treatment of which is entirely surgical, but chronic intussusception, when it occurs, and this is rarely indeed, comes perhaps more often to the physician than to the surgeon for diagnosis. In all the 4 cases upon which my remarks are based, the child was sent by the puzzled practitioner to a physician not to a surgeon for help in the diagnosis because the symptoms had not suggested any condition requiring surgical treatment.

It is chiefly upon the diagnosis of chronic intussusception that I wish to dwell, for it is sometimes very difficult and the child's life depends on it. The term "chronic" is here used to mean cases in which the intussusception is present for many days or even weeks without producing any acute obstruction. Ultimately, if unrecognized and unrelieved, these chronic cases may terminate with symptoms of obstruction, but before this stage is reached there may be weeks during which symptoms are of the vaguest and most deceptive character.

The condition is overlooked usually because the idea of intussusception is associated with the picture of acute intestinal obstruction and with bloody stools, such as we are all familiar with in the common case of acute intussusception. Perhaps also there has been too much insistence on the fact that when chronic intussusception does occur it is in older children or in adults. The 4 cases described here had their onset respectively at 13 months, 14 months, 23 months, and  $3\frac{1}{2}$  years.

If one may construct a composite case from this small experience, it is somewhat as follows: On a particular day the child seemed to have pain in the abdomen and vomited once or twice. During the next few days he occasionally vomited, generally in association with a colicky pain. The vomiting has become less frequent, only once in two or three days, and the pain is only occasional. The bowels, which before were open daily, have since the onset been less regular, aperients have been neces-

sary, but when given have worked well and the stools have been normal; there has been no blood in the stool or at most there has only been a streak once or twice, such as might be seen on the stool of any constipated child. The symptom which has troubled the parents most is the wasting; the child after three or four weeks of these vague troubles is obviously getting thin. The temperature throughout has been normal. Such is the history, and with a duration of some weeks even the finding of a more or less definite lump in the abdomen may hardly raise a suspicion of intussusception, especially when the mother's chief complaint is the wasting. Nevertheless, it is by the detection of the more or less sausage-shaped tumour and especially by its varying consistency from moment to moment during palpation that the diagnosis is to be made; to the tactus eruditus also the unnatural emptiness of the right iliac fossa (Dance's Sign) may be useful confirmatory evidence as in the ordinary acute intussusception.

Turning now from the general to the particular, I would first emphasize the length of time during which a chronic intussusception may be present, and that without producing any apparently serious disturbance of the child's general health. In my 4 cases, all of which made rapid and uninterrupted recovery after operation, the duration, reckoned from day of onset to operation, was as follows: In the infant, who was 13 months old at time of onset,  $4\frac{1}{2}$  weeks (32 days); in the infant, who was 23 months old at onset,  $4\frac{1}{2}$  weeks (32 days); in the infant, aged 14 months at onset, exactly 6 weeks; and in the child, aged  $3\frac{1}{2}$  years, exactly 3 weeks; in none of these was the general health much impaired, apart from the loss of flesh already mentioned.

The entire absence of blood from the stools throughout, or the slight and transitory character of the bleeding when present, are features of chronic intussusception, which might mislead.

One of the 4 cases was a striking illustration of this: Derrick D., aged 14 months, vomited on Christmas Day and appeared to have pain in the abdomen; the pain, however, passed off and the vomiting ceased the same day. From that time, he began to lose flesh, and constipation became troublesome, necessitating the use of aperients. After the lapse of about 4 weeks, occasional vomiting occurred, but there was no return of pain at any time. There was never during the whole 6 weeks, from onset to opera-

tion, any blood passed from the bowel. The child was sent by two doctors to a consultant, who felt a transverse mass below the liver on the right side and diagnosed tubercular peritonitis. Wasting continued and the parents brought the child to London; they were distressed chiefly at the loss of flesh, which was noticeable, but not extreme. The chest was normal; the abdomen was full and on the right side, below the liver, was a transverse mass roughly sausage-shaped but seeming to have a somewhat nodular bulbous beginning on the right side and a more smoothly rounded continuation as far as the midline of the epigastrium or just beyond this. After examining this on two occasions, I satisfied myself that it varied in hardness during palpations as if undergoing some active contraction. Moreover, the right iliac fossa seemed unduly empty. Intussusception was diagnosed and my colleague, Mr. Barrington-Ward, operated on February 4, the 42nd day after onset, and reduced without difficulties what proved to be an ileocaecal intussusception. The child made an uninterrupted recovery.

This case illustrates the mistake in diagnosis, which seems to be the usual one in these cases, namely to regard the condition as tubercular peritonitis. The usual position of the intussusception tumour just below the liver, and the association of this transverse mass with wasting, is so suggestive of tubercular peritonitis with its transverse mass of thickened caseous omentum that the mistake is not difficult to make.

The diagnosis between these 2 conditions depends chiefly upon the detection by careful palpation of the alternate hardening and softening of the intussusception tumour during palpation, a feature lacking in the caseous mass. In 2 of the 4 cases, I noticed particularly before operation that the right end of the tumour was of an irregular, nodular, almost knobby character, which apart from the smoother sausage-like continuation might easily have been mistaken for a mass of firm tubercular glands. At operation, it was seen that this was due to bunched-together glands, appendix, and mesentery partially dragged into the intussusception. The unnatural emptiness of this right iliac fossa helped in 2 cases to differentiate from tubercular disease, but this sign is easy to imagine when one is specially looking for it, so that one must needs be careful in attaching weight to it.

Three out of the four cases certainly, and I believe the fourth case also, had been diagnosed as tubercular peritonitis by one or other of those who saw them. The following are two such: Audrey D., aged 23 months, on the night of April 8th vomited, next day the bowels were loose and this looseness was followed the next few days by occasional abdominal pain. On the fourth day after the onset, there was a trace of blood in 3 of the stools, but on no subsequent occasion was any blood passed. Pain in the abdomen continued to recur at intervals and on the tenth day of the illness a consultation was held and the possibility of intussusception considered, as there was a suspicion that the "transverse colon was felt too easily." The bowels continued to be open but aperients were now necessary, the child cried before passing stools and at a second consultation a diagnosis was made of "fissure of the anus." On some days the child would vomit once. The appetite had become very poor so that it was difficult to get her to take food. At this stage I was asked to see the child and being informed that the child greatly resented examination, I arranged to see the child at night, when she was asleep. A transverse sausage-like mass was then easily felt in the epigastrium and its variations in firmness under palpation settled the diagnosis. The next day a surgeon was called in with a view to operation, but although consenting to laparotomy, he took the view that the case was one of tubercular peritonitis, not of intussusception. The operation, done on the 32nd day after onset, showed a large intussusception, which was reduced without much difficulty, though there was much swelling of the wall of the cæcum and some adhesions had formed. The child made a rapid recovery.

David T., aged 13 months, vomited on April 28 and seemed to have pain, the stools contained some mucus but no blood. After this there was an occasional vomiting every third or fourth day, associated with pain, which seemed to be less than at onset. The child took very little food and wasted much, and became weak. The stools became quite normal at times, but were some times green with mucus in them; only twice was there a trace of blood in the mucus. At times a vague mass had been felt in the epigastric region and a diagnosis of tubercular peritonitis had been suggested, though the possibility of intussuscep-

tion had been recognized. It was not until the 32nd day (May 30) that the tumour of intussusception was recognized with certainty and operation done. Reduction was easy and recovery rapid. In this case, as in all the others, there was one point which should have militated against a diagnosis of tubercular peritonitis, namely the very definite sudden onset. In all 4 cases, the parents could tell the exact day on which the child was taken ill, and in some even the time of day.

One of the cases just described illustrates the practical difficulty which may arise when from fretfulness or timidity, the child cries and makes the abdominal muscles rigid when any attempt is made to palpate. This no doubt might be overcome by an anæsthetic, but it was readily obviated in this case by examining the child during sleep, surely a much better way than the infliction of the fright and risk of an anæsthetic; it is time enough to resort to an anæsthetic when an operation is found to be necessary. It is surprising how much can be done in the way of examination of a child when it is asleep, provided the doctor's hands are warm and the touch gentle. In children, suspected of cerebral disease or meningitis, it is often possible to make a good examination of the optic disc and fundus of the eye during sleep. In the case described above not only was the abdomen thoroughly palpated and the character of the tumour ascertained exactly, but even a digital examination per rectum was made without waking the child.

The following case, beside illustrating the point just mentioned, shows that vomiting, even of occasional occurrence, is not necessarily a persistent feature of chronic intussusception. It would seem from the history of all the cases mentioned here that vomiting on the day of onset is a usual, if not a constant feature, but after the first day or two, there was in 3 out of the 4 cases only an occasional vomit at intervals of some days. In the following case vomiting was entirely absent after the first two days, although the intussusception lasted 3 weeks.

Isabel B., aged  $3\frac{1}{2}$  years, was seized with pain in the abdomen on February 8 and was sick. She vomited several times on this and the following day but throughout the rest of the illness there was no vomiting at all. The bowels were open regularly every day and only once, a week after the onset, a spot of blood was



noticed on the stool. There was recurring pain, referred to the umbilicus, several times daily; it was sufficient sometimes to make the child cry. The temperature was normal. The child, though fairly nourished, had lost flesh since the onset. When the child was first seen, a soft mass could be felt just below the liver, but a subsequent attempt to palpate was frustrated by the child screaming and stiffening her muscles so that no diagnosis could be made. It was therefore arranged to examine the child at night when asleep, and no difficulty was then experienced; the tumour was easily palpated and found to show the characteristic features of intussusception, which the emptiness of the right iliac fossa seemed to confirm. Operation done on February 29 (the 21st day after onset) by Mr. Barrington-Ward, resulted in easy reduction of the intussusception and uninterrupted recovery.

There is one addition to diagnostic methods which has not been mentioned; it was used only in one case, Derrick D., namely the use of bismuth meal and x-rays. It gave no assistance in that case, and a comparison of the x-ray interpretation with the findings at operation only served to confirm one's impressions gained from many other abdominal conditions, that great caution is to be exercised in attaching any diagnostic significance to bismuth meal skiagrams.

I have said nothing about the varieties of intussusception found. In 3, it was ileocæcal; in 1, the last mentioned, it was ileocolic. In all there was great swelling and congestion of the wall of the intussuscepted bowel, and in 2, the long duration had allowed formation of some fibrous adhesions between the adjoining mesentery and the bowel. In none was any fixation attempted to prevent recurrence, and although the earliest was nearly 8 years ago, and the latest a year ago, none have so far as I know had any recurrence.

## SOME FORMS OF CARDIAC IRREGULARITY

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In a sense, it is normal for the cardiac action in early life to be irregular. Just as the rate of the heart is altered by trifling causes, so is the regular rhythmic action very easily disturbed. In both cases, the cause does not lie in the tissues of the heart muscle, but in the nervous control from the higher centres. In the case of an acceleration of the heart rate, as from any emotional excitement, the stimulation comes through the sympathetic system and the nervous accelerans. In the case of slowing of the heart rate, the stimulus comes through the cerebrospinal system and the vagus nerve. Both these nervous centres are active from the time of birth, but are not in a stable condition until after adolescence. Under fully developed conditions, the balance between the opposing nervous influences which act on the heart is such that a regular heart rate and a regular rhythmic beat of the heart is established. This is best seen when an adult is in a condition of mental and physical rest, and when this condition is disturbed, the only effect produced is an acceleration of rate without any change in the regularity of the heart beat. In the case of children, the acceleration of rate under excitement attracts no notice, because it is regarded as normal and physiological. An irregularity of the heart or pulse beat is often looked on as a different matter, yet in childhood it is also physiological. Under vagal action, a slowing of the heart rate occurs at intervals, which gives to the pulse a feeling of irregularity of beat, owing to the varying length of the diastolic pauses. Sir James Mackenzie has called this "the youthful type of irregularity," but it really dates from birth and may be actively present during the first 2 decades of life. School medical officers, who are not familiar with this type of irregularity in childhood, are apt to diagnose heart trouble when none is present.

The chief factor in this disturbance of the regular action of the heart is the act of respiration which, like the act of swallowing, has a distinct effect on the vagal centre. Under normal conditions, inspiration diminishes vagus activity, and the heart beats more quickly, while expiration increases vagal action and

the heart beats more slowly. The more slowly the heart is beating the more marked is inspiratory quickening and expiratory slowing of the heart rate. These are the physiological factors which underlie the normal working of the heart in childhood.

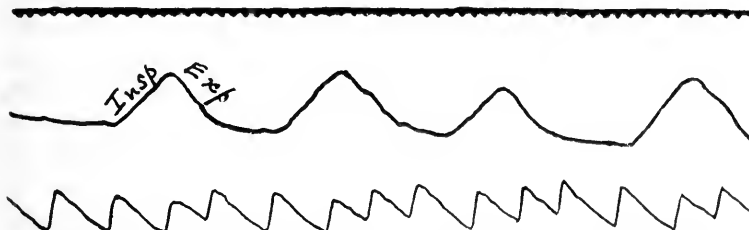


FIG. I. Sinus irregularity of respiratory type. The lower (arterial) tracing shows the inspiratory quickening and expiratory slowing of the pulse rate.

In the majority of cases, the diastolic variation which is present does not attract the notice of the clinical observer, and it may be necessary to take a radial tracing in order to demonstrate it.

In other cases, the irregularity of the pulse or the heart is so great as to attract notice at once. One notes a few quick beats followed by one or two of lessened frequency, and this alternation of rates is kept up (Figs. I and II). Or it may be that the observer is struck by an inequality in the force of the pulse beat, the frequent beats showing a feebler pulse, and the less frequent beats a stronger pulse (Fig. III). Familiarity with the condition

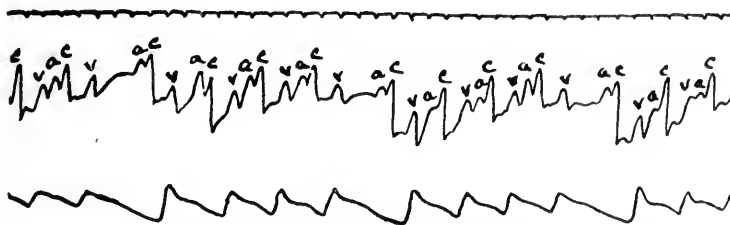


FIG. II. Sinus irregularity of respiratory type. The long pauses in the lower (arterial) tracing are seen also in the upper (venous) tracing. During these long pauses, the whole heart stands still. The venous and arterial tracings are normal in early life.

leads one to observe the respiration and compare it with the cardiac action. When the patient breathes slowly and deeply, the irregularity will be increased; when he breathes quickly, it will be less marked; and when he holds his breath, the irregularity will disappear.

Under certain conditions, this sinus irregularity of respiratory origin is specially well marked. It is very common during the convalescent stage after acute illness, when the heart beats slowly. Owing to this fact, cardiac irregularity is sometimes diagnosed after an attack of pneumonia, or measles, or scarlet fever, and treatment may be ordered for what is only a physiological variation in the cardiac action. In many intracranial diseases, such as meningitis, cerebral abscess or tumour, encephalitis, etc., the heart rate is slow and this sinus irregularity is well marked. In such conditions, also, the breathing is often irregular, being cyclic in character, and this will be reflected in an increased sinus irregularity of the heart. On the other hand, all illnesses or diseases which tend to increase the rate of the heart are accompanied by a diminution or disappearance of this sinus irregularity.

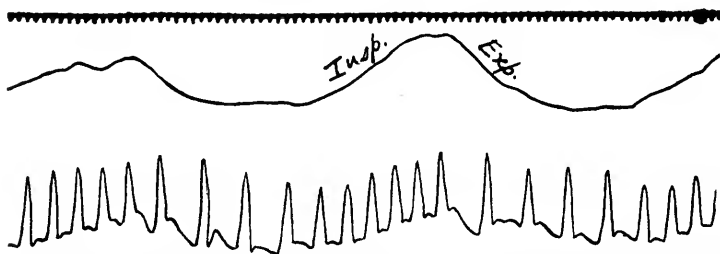


FIG. III. Sinus irregularity of respiratory type. The lower (arterial) tracing shows a weakening of the beat during the inspiratory and faster phase, and a strengthening of the beat during the expiratory and slower phase. The upper tracing is respiratory.

When the only irregularity present is due to respiratory action, the condition is usually easily recognized and should never present any real difficulty. Sometimes there is present, in addition, some other form of irregularity, such as that due to extra-systoles, and there is thus a compound irregularity which may puzzle the clinical observer. In such cases, it may be necessary to take a graphic record of the arterial and venous movements before one can decide as to the exact nature of this compound irregularity.

Extra-systoles or premature contractions are met with in childhood in connection with organic disease of the heart and also when no disease can be determined in the heart or elsewhere. In rheumatic heart disease, extra-systoles may occur during the active stage of carditis, but more frequently during the quiescent

period when the heart rate has slowed down. Children of a nervous temperament not infrequently show extra-systoles, apart from any heart disease, which appear and disappear in the most puzzling manner. As a rule, in such cases, the patient is quite free from any symptoms caused by the extra-systoles, and is in fact quite unconscious of the condition, so that the less notice taken of it the better. Some children seem to have been born with a tendency to extra-systole production, and this tendency lasts through childhood. Some families even show this tendency. It would appear that extra-systoles are not necessarily induced by any myocardial change, as in the case of organic heart disease, but may arise through the nerves which control the heart. It is certainly difficult to explain otherwise the occurrence of extra-systoles in a child whose heart is apparently sound and who has had no disease likely to affect the heart. Be this view sound

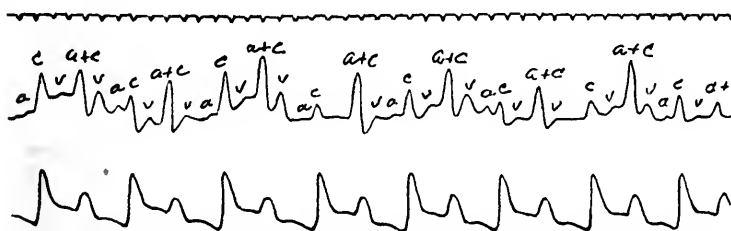


FIG. IV. Pulsus bigeminus due to regularly recurring extra-systoles. The upper (venous) tracing shows the extra-systoles in a series of large waves (a + c) indicating that auricles and ventricles contracted at the same time.

or not, there can be no doubt that it is extremely unwise to treat as the subject of heart disease a child in whom the only abnormal condition found has been an irregular action from occasional extra-systoles.

The detection of extra-systoles, as the cause of cardiac irregularity, is usually easy. On auscultation of the heart, the regular rhythm is interrupted by the premature beat (1 or 2 heart sounds), which is followed by a longer interval than usual before the next beat. A typical illustration is seen in this tracing (Fig. IV), where the pulsus bigeminus, due to a regular sequence of extra-systoles, is shown. In the radial tracing, every second beat is weak and premature and is followed after a longer interval by a full, strong normal beat. Each extra-systole is marked in the venous tracing as a large wave, due to the simultaneous contraction of auricles and ventricles. This tracing was taken from a

well nourished girl of 14 years, who presented no signs of organic heart disease. A week later, the pulse and heart were quite regular and not a single extra-systole was heard.

A typical example of the pulsus bigeminus, due to extra-systoles, as in the above case, may have to be distinguished from other conditions. A girl of 6 years, while recovering from an attack of acute anterior poliomyelitis, was found to have a bigeminal form of pulse, a small beat following a large beat in regular sequence. The cardiac rate was 65 and she presented no evidence of organic disease of the heart. On auscultation, the heart sounds appeared to be normal and equally strong in the

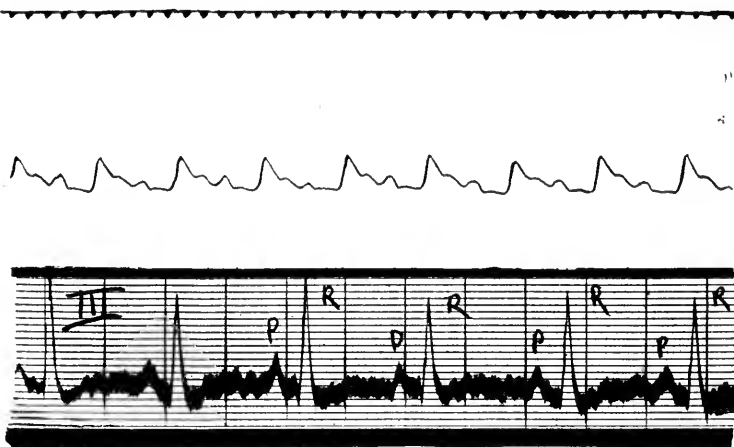


FIG. V. Pulsus alternans. The upper tracing shows the stronger and weaker beats as felt in the radial artery. The lower (electro-cardiograms) shows a normal sinus rhythm and regular rate but a change in the ventricular beats.

successive beats. The only irregularity was in the pulse with its regular sequence of big beat and little beat. The difference in the beats is well shown in the tracing (Fig. V). Although, at first, one might be inclined to describe this as due to extra-systoles, it will be noted that the small beat does not occur prematurely, and further that it is not followed by a pause longer than usual. In fact, the converse is the case as the interval after the little beat is shorter than that which precedes it. The accompanying electro-cardiogram shows that the rhythm of the heart is normal. The condition is one of pulsus alternans, of unexplained origin, and apparently of no grave import. Although

the condition lasted while she was under observation in hospital, the child was reported to be well a year later, save for the effects of the poliomyelitis on the limb muscles.

Yet another condition in childhood may suggest the pulsus bigeminus and extra-systoles, namely, when, along with very rapid and regular breathing, the pulse rate is not very much increased. The accompanying tracing (Fig. VI) was taken from a girl of 7 years, suffering from cardiac failure, the result of rheumatic heart disease. The pulse rate was 100, and the beats seemed to be of unequal strength, every second one being weaker than the others. The upper part of the tracing is the respiratory curve, which shows regular breathing at the rate of 50 respirations per minute. The lower part is a radial tracing and shows the sequence of big beats and little beats. On measurement, one finds that the intervals between the beats are exactly equal, there

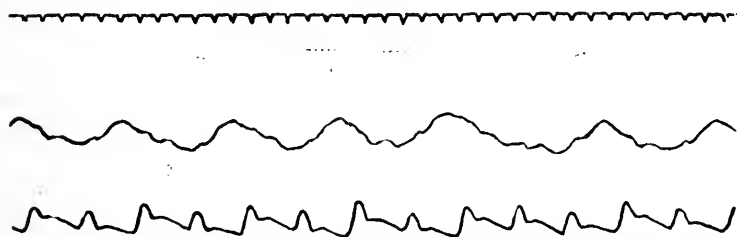


FIG. VI. Pulsus pseudo-alternans. The lower (radial) tracing shows a pulse rate of 105 and is apparently due to the pulsus alternans. The upper (respiratory) shows a rate of 50 per minute and is directly associated with the pulse condition (see text).

being no evidence of premature contractions. It was impossible to take a venous tracing owing to the dyspnoea present. The nature of the irregularity was shown by getting the patient to stop breathing, when the pulse beats at once became of equal size and strength, and continued so as long as the breath was held. This is a condition of pseudo-pulsus alternans, associated with and due to very rapid respiration in the presence of a weakened circulation. It is probably dependent more on the disturbance in the circulation of the large intra-thoracic blood vessels than the cardiac action.

When extra-systoles are frequent and regularly repeated, they may induce still further disturbances of the pulse beat. This compound form of irregularity is more difficult to detect clinically and to unravel from a graphic record. A girl, aged 13, had

been under observation for some years, suffering from recurring attacks of rheumatic infection. The heart was greatly hypertrophied, partly as the result of previous valvulitis, but chiefly owing to pericardial adhesions. The cardiac rate was usually



FIG. VII. Pulsus trigeminus, due to extra-systoles and pulsus alternans. The upper (respiratory) tracing shows that the radial irregularity is unaffected by the breathing.

rapid but it had always been regular until one day the pulse showed marked irregularity. On feeling the pulse, what was noted was a triple rhythm, 1 strong beat followed by 2 weaker ones. This sequence was repeated with constant regularity—and might be described as the pulsus trigeminus. On auscultation, the heart sounds were equally loud at all the beats, but every third beat seemed to be premature and to be followed by a longer pause than the other two beats in the cycle. The cardiac rate was 120 per minute and there were no fresh symptoms associated with the cardiac irregularity. A radial tracing (Fig. VII).

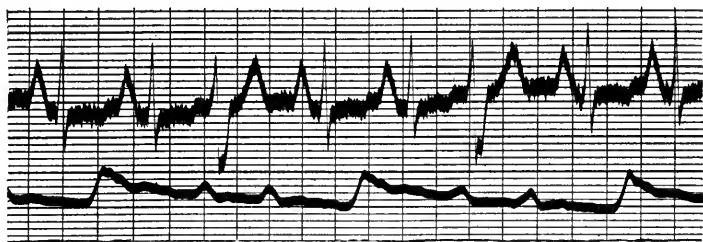


FIG. VIII. Pulsus trigeminus, due to extra-systoles and pulsus alternans. The radial tracing (lower) shows the same type of irregularity as in the last figure. The upper shows the presence of recurring extra-systoles at every third beat.

showed a puzzling form of irregularity, which was clearly not due to the effect of respiration. I am indebted to Dr. John Parkinson for the accompanying electro-cardiogram (Fig. VIII), taken from an adult case, and also for the explanation of the tracing which appears to me to meet the case. The basis of the disturb-





diac weakness (breathlessness, œdema, etc.). In order to secure benefit, it is now generally recognized that digitalis must be given in much larger doses than were formerly given, and that these doses must be continued until some of the physiological effects of digitalis are induced. In doing so the regular action of the heart may be changed into an irregular one. In the slowing process the occurrence of extra-systoles is common and does not seem to have much significance. On the other hand, the onset of coupled beats is a danger signal and calls for immediate cessation of the drug. Certain other irregularities occurring under digitalis will now be referred to.

In adult cases, if the action of the heart was previously regular, the induction by digitalis of that irregularity known as heart block is not uncommon, the block occurring at the auriculo-ventricular node. This may be seen also in childhood, although in my experience it is uncommon, and is the result of over-dosage with digitalis. A girl of 13 years was seen because of arthritis and pains in the limbs. She gave a history of tonsillitis 8 weeks previously, but of no other evidence of rheumatic infection. The cardiac condition and the presence of many subcutaneous rheumatic nodules pointed to rheumatic infection of much longer standing. The heart was not dilated but the rate was 120 per minute and well marked signs of mitral and aortic regurgitation were present. She improved under treatment by salicylate of soda, and later she was put on digitaline (Nativelle) in order to slow the heart rate. I saw her after a month of this treatment. There was very definite cardiac dilatation and hypertrophy, and the pulse was very irregular. The pulse rate varied from 80 to 100, and some of the diastolic intervals were very long. A tracing (Fig. X) showed a condition of partial heart block at the auriculo-ventricular node, sometimes all the auricular impulses passing through, sometimes one missing, and sometimes a condition of 2:1 heart block being present. The irregularity passed off when the digitalis was stopped.

A more common effect of digitalis therapy is the induction of sino-auricular block and this may be studied in its most characteristic form during childhood. It is to be recognized clinically by the occurrence of one or more apparently missed beats in the pulse; these missed beats increase in frequency so that there come to be periods in which they predominate, and alternating with

them are periods in which the faster rate predominates. We may find on listening to the heart that at one time it is beating steadily at the rate of 40 per minute, and that quite suddenly this changes to a rate of 80 per minute, while the cardiac action, during the slow and during the faster period, is quite regular. This is not the result of a missed beat from extra-systoles, but is due to a block at the sino-auricular node during the slow periods. As a rule, it is a partial block of the 2:1 variety, so that at the time of every second beat there is no impulse discharge from the sino-auricular node, and the whole heart stands still until the next beat is due and is successfully initiated and carried through.

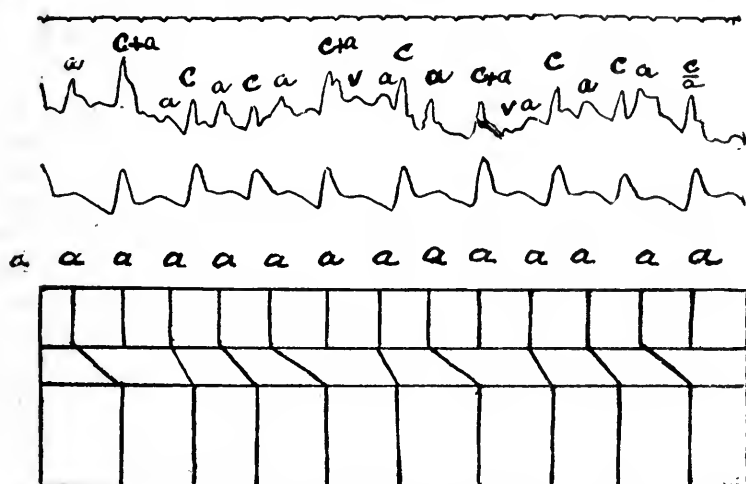


FIG. X. Partial heart block caused by digitalis. The irregularity in the radial tracing is shown in the venous tracing to be due to the irregular contraction of the ventricles. The diagram below shows the regular auricular action and supplies the key.

The condition is the result of the stimulation of the vagus nerve by digitalis and the powerful control which the vagus exerts over the sino-auricular node—the pacemaker of the heart, as Lewis terms it.

A girl of 7 years was admitted to hospital suffering from a severe cardiac breakdown, associated with pyrexia, cyanosis, œdema and breathlessness. The condition had somewhat improved at the end of 3 weeks, after which the temperature was sub-normal, but the pulse continued rapid, the rate being 130 to 140 per minute. The action was always regular and a normal sinus rhythm was present. The heart was much enlarged and signs

of mitral regurgitation were present. After digitalis had been given for 17 days in moderate doses, the pulse rate fell to 110 and improvement set in. A few days later an irregularity of the pulse was noted for the first time. It took the form of 1, 2, 3, or 4 less frequent beats occurring at irregular intervals. Gradually



FIG. XI. Sino-auricular block caused by digitalis. In this pulse-tracing, the faster rate and the slower rate are shown.

the frequency of these slower beats and also their number increased, until they came to equal in number the periods of the ordinary rate (Fig. XI). Analysis of these slower periods showed that each slow beat almost exactly equalled in duration 2 of the faster ones, allowance being made for a slight sinus irregularity due to respiration. At the faster rate, the heart was beating 100 times a minute, and at the slower rate 50 times a minute. There were thus 2 distinct rates of cardiac action, alternating with each other, each preserving its characteristics with perfect regularity, each starting and ending abruptly, and each



FIG. XII. Sino-auricular block caused by digitalis. The radial tracing shows the transition from a slower to a faster rate. The venous tracing shows that during the slower beats the whole heart stood still through diastole.

being of sinus origin (Fig. XII), without any evidence of other disturbance in the conducting tissues of the heart. Naturally the cardiac contractions during the slower period were very much stronger than those during the faster period, as evidenced by the pulse.

In a recent case, I tested this variation of heart rate under digitalis in another way, in order to determine how far the disturbance was really due to the action of digitalis on the vagus nerve. The patient was a girl of 9 years, the subject of rheumatic carditis, who required to take digitalis regularly in order to reduce the heart rate and maintain freedom from symptoms of cardiac failure. Like many other patients, she frequently omitted to take her medicine and I had numerous opportunities of restoring her by means of digitalis. The variation in rate under digitalis had been noted on several occasions. On one of these, after a course of 9 granules of digitaline (gr. 1/240th), it was noted: "The patient vomited this morning. The pulse rate is 60, a normal sinus rhythm is present in the heart, as shown by the tracings, and the regularity of the heart beat is interrupted only by an occasional extra-systole." Two days later it was noted: "There is to-day a variation in the rate of the heart, which at one time

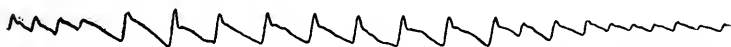


FIG. XIII. Sino-auricular block induced by swallowing. The tracing shows the sudden alteration of rate following the act of swallowing, the duration of this effect, and the return to the previous rate.

is beating at 112, and at another at 60 per minute. Allowance being made for a slight respiratory variation in the length of diastole during the slow periods, the slow rate is almost exactly double that of the faster. A sinus rhythm persists all through as shown by the arterio-venous tracings. When the faster rate is present, it can be changed at once to the slower by making the patient breathe deeply and slowly." This last fact indicated that the variation in heart rate was due to periodic over-action of the vagus, which induced at times a slower rate by sino-auricular block. A further test was made 3 days later, when the heart rate was 108 and as a rule regular, only a few solitary beats of the slower rate intervening occasionally. The patient was asked to swallow a mouthful of cold water and as soon as this was done the heart rate changed abruptly from 108 to 54 per minute—that is to one-half of the rate. The act of swallowing thus induced the same type of alteration in the cardiac rate which digitalis

alone had done 3 days previously. The slow period was maintained for from 9 to 11 beats (Fig. XIII), and then the faster rate was resumed. This swallowing test was repeated several times and always with the same result. On the other hand, deep, slow breathing did not on this date produce any slowing of the heart rate, as it had 3 days previously, showing that the vagus required a stronger stimulus to induce sino-auricular block. According to physiological teaching, the act of swallowing stimulates strongly the vagal centre and through it slows the heart rate. Mackenzie has given some illustrations of this effect of swallowing on the heart rhythm in patients who had been taking digitalis.

So far as my experience has gone, this variation of the heart rate, due to a block at the sino-auricular node, is only found in the case of children amongst those who have been taking digitalis. It is one of the results of vagal stimulation by digitalis. The condition may strike one as curious and may cause anxiety if one is not familiar with the type of irregularity. It is not a dangerous condition and does not indicate any serious heart complications, but, if it appears during the administration of digitalis, the drug should be discontinued for a time, as the vagal stimulation has gone far enough.

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ABDOMINAL PAIN IN CHILDHOOD (British Medical Journal, Jan. 1, 1921). The possibilities to be considered when confronted with a case of severe abdominal pain in childhood, R. Hutchison says, are acute indigestion, appendicitis and some form of acute intestinal obstruction of which that due to intussusception is especially frequent. Among the rarer causes are abdominal or Henoch's purpura and renal colic. In children, chronic or recurring abdominal pain usually has its seat of origin in the intestine. Ordinary indigestion may cause some pain, probably from distension of the stomach with gas, but it is rarely severe in degree—rather a mere discomfort—and its definite relation to meals and its relief after the belching up of wind will usually make the nature of the case plain. The intestinal cases are far more common. They are due to: (a) ordinary colic; (b) umbilical colic; (c) enterospasm, and (d) chronic obstruction.—*Journal A. M. A.*

## HYSTERIA IN THE NURSERY AND IN WARFARE— A COMPARISON AND A CONTRAST

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"Hysteria is a pathological state manifesting itself by troubles, which it is possible to reproduce by suggestion, in certain individuals, with perfect exactitude and which can be made to disappear under the influence of persuasion (contra-suggestion) alone."—*J. Babinski*.

"Hysteria is the condition in which symptoms are present which have resulted from suggestion and are curable by psychotherapy."—*A. F. Hurst*.

### (1) THE FREQUENCY OF HYSTERICAL SYMPTOMS IN EARLY CHILDHOOD

It does not require great familiarity with the ways of children to realize that their conduct, good or bad, is determined by the personal influences and suggestions of those who are most closely in contact with them. When mother and nurse are cheerful, light-hearted and optimistic, when stress is laid upon success and achievement and not upon failure, the average child proceeds from strength to strength. He is moulded passively in accordance with the reputation which attaches itself to him in the household. Without any power of self-analysis, he looks upon himself with the eyes of his elders as one of whom it is characteristic to eat, without question, what is put before him, always to sleep well and to be conspicuously regular in the daily action of his bowels. On the other hand, when the whole atmosphere in which his little life is passed is pessimistic, apprehensive and lacking all calm and confidence, the response in the child is immediate and certain. It is then that we meet with such symptoms as refusal of food (a sort of anorexia nervosa), refusal of sleep, enuresis and constipation. Whatever is feared for the child, whatever occasions most distress to the parents, to that, not unconscious of his power to disturb, the child seems irresistibly compelled. Yet his power of dominating the situation by his abnormal conduct affords him no satisfaction. It is clear that he too shares in the unhappiness and sense of alarm.

No doubt children differ greatly in their susceptibility to such suggestions. With some, gross faults of management produce but little disturbance. Others, quick and sensitive, reflect at once in their every action even the passing moods of mother and nurse.

If we accept the definitions of hysteria set out above, many of these disturbances of childhood must be classed as hysterical. Certainly they result from suggestion and are cured by counter suggestion. We can even, with propriety, speak of a *physiological* hysteria of childhood, meaning thereby that the most normal child will fall under the influence of any suggestion which is persistently made to him by the grown-up persons around him. In the past, however, it has usually been taught that hysteria in early childhood, is a disorder of great rarity. This apparent contradiction can be easily explained, if we enquire particularly into the nature of the suggestions which are commonly made to the young child.

*Example.* A small boy, 5 years old, was brought to me suffering from a hysterical contracture of the hand of 6 months duration. The mother of this little patient was much distressed by the misfortune which had befallen him, and was in a state of the greatest agitation. She repeated over and over again that she was at a loss to account for the appearance of the contracture and reiterated that she had not neglected it but had massaged the arm many times daily for many months. It is noteworthy that during our first interview, she was in tears for the greater part of the time. The separation of the child from this poor mother at once produced improvement and ultimately complete recovery.

Now hysterical symptoms, such as contracture, paralysis or anesthesia are without doubt of extreme rarity in early childhood. But why? Only because suggestions of this particular nature are seldom made. The hysterical symptoms of the child are the fruit of the doubts, the forebodings and the anxieties of the parents. Nervous vomiting, constipation, anorexia nervosa, pica, insomnia, disorders of micturition, such as enuresis or undue frequency, bulimia or an apparently insatiable thirst which arouses fears of diabetes insipidus, are comparatively common troubles in many nurseries, and they are common because it is upon these things and not upon paralysis, contractures or anesthesia that the mind of the over-anxious mother commonly dwells. The frequency with which hysterical symptoms in childhood are concerned with



the digestive system and with the urinary function is thus easily explained. Parents do not commonly fear the onset of organic nervous disease and all such suggestions therefore are lacking. On the other hand, it is upon the sensitive digestive system that their attention is concentrated, with the result that in the digestive system we have presented a very great variety of hysterical symptoms.

## (2) THE GENESIS OF HYSTERICAL SYMPTOMS IN SOLDIERS AND IN CHILDREN

Symms\* has set clearly before us the factors which lead to the production of hysterical symptoms in soldiers—the interest aroused in the mind of the medical officer, the unconscious suggestions proceeding from elaborate and particular examination, the effect of long continued and ineffective treatment, the sympathy of the attendants, the stir and interest aroused among other patients and the close contact with other sufferers equally or more grievously afflicted. In the production of hysteria in the nursery, we find similar forces at work. The fault lies in the too scrupulous care of parents and nurses who are unable to hide their fears and apprehensions from the sensitive and receptive child. In both cases, the evil is inherent in the good. Each shows the defect of good qualities, the bad side of what is otherwise to be commended. Being careful so easily degenerates into being too careful. It will be enough to mention 1 or 2 cases which are typical because they show clearly the origin of the symptoms in the distress of mind of the parents.

*Typical Cases.* 1. A little girl, 2 years old, for the first time in her life, for some unexplained reason, but perhaps because she choked, suddenly vomited during dinner. The nurse, who was a very intelligent woman with a remarkably vivid and vivacious way of talking, called out in horror and distress at this unexpected happening and immediately rushed from the room to summon the mother that she too might come and witness the disaster. The event was discussed openly in the hearing of the child, who thoroughly appreciated the stir which her conduct had created, and shared in the general interest and anxiety. At the same hour, on the next day and at the same stage of the meal, the vomiting was repeated and again on the third and fifth days. At this point, the origin of the trouble was explained to the mother.

\* "The Responsibility of Medical Officers in the Production of Hysterical Symptoms in Soldiers," J. L. M. Symms. *Seale Hayne Neurological Studies*, Vol. 1, No. 2, Sept., 1918.

The child was taken to the dining room, away from the nursery, for her meal and no reference was made to the possibility of recurrence, but everything was done to occupy her attention with her new surroundings. There was no further vomiting, and after a few days the child was returned to the nursery and the usual routine renewed. In this case the hysterical vomiting was thus early cut short.

2. A small boy of 3, an only child, who was looked after entirely by his mother, a very nervous woman mourning the loss of her husband in the war, was brought to me for persistent vomiting of many months duration. He was a highly nervous and excitable child, showing many symptoms of nervous unrest, such as refusal of sleep, refusal of food, and persistent restlessness and negativism. Matters had come to such a pass that he had contracted the habit of vomiting whenever the white cloth was put upon the nursery table in preparation for a meal. The sight or sound of the preparation of food was sufficient to evoke a paroxysm of refusal and "negativism." The mother was quite unable to hide from him the distress which his conduct caused. Under the care of an understanding nurse, the vomiting soon ceased and he ate well, although the trouble returned when this particular nurse left him and she had to return to effect a cure a second time.

3. A boy of 4, who had been adopted by a maiden lady, was brought for persistent constipation. Often several days passed without an evacuation in spite of persistent use of aperients. When placed on the stool he cried and resisted so violently that at one time it had been thought that there must be a fissure of the anus. The same negativism however was shown in many other ways. Thus, he always cried and struggled when put to bed and he could not be got to eat green vegetables or milk puddings or to drink milk. As might be expected, the so-called constipation could only be overcome by the use of purgatives so strong that the inhibition gave way in the presence of a watery stool. Milder laxatives were quite without effect. The lady, who had adopted him, added 3 other observations of great significance. She said that the constipation, when at its worst, always made the child restless and irritable. She said that it had become much more severe since a new nurse, who was much dis-

tressed by it, had taken charge of the child. She said that it always disappeared and gave rise to no trouble when the child was taken to the seaside. In other words, the constipation was readily influenced by the attitude of the nurse towards it; it became worse with the ennui and fractionousness which too often characterize life in the restricted environment of an only child in town and disappeared when his thoughts were wholly given to the delights of the seashore.

4. A boy of 4 suffered from the infirmity that in public places he was unable to resist pulling his nurse's petticoats over her knees. There was here at least no need for psychoanalysis to attach any sexual motive or meaning to the act. The child in his frequent struggles with his nurse had accidentally stumbled upon this action, which he learned by experience could be relied upon to produce a pleasant stir of shocked surprise and to provoke expressions of horror from all beholders. Repeated and severe whippings had not broken him of the practice. Similarly children will sometimes repeat objectionable or forbidden words or phrases if by so doing they can visibly distress their anxious parents. In this case, when the parents and nurse ceased to expostulate and allowed his attempt to fall flat, the sport soon lost its savour and in a few weeks' time he ceased altogether to make the attempt.

On examining these 4 cases, typical of many others, it seems clear that we must regard the first 2 as coming within the definition of hysteria. They are examples of hysterical vomiting. Similarly I think it may be argued that the third case, one which is of everyday occurrence in the nurseries of the well-to-do, is an example of an hysterical inhibition of defecation. The fourth case, I have included to show the difficulties which surround an attempt to adopt a nomenclature which carries with it a very precise meaning. In all of these disturbances of conduct we can distinguish 2 forces at work, firstly, the force which is due to the undisguised distress of the parents and secondly, the force which is the desire of the child to attract attention and to make his little world revolve around him. Of these, the second lies deeper. The suggestions from the parents merely provide the outlet. They do not supply the motive. Every child in the presence of his elders is bound at times to be assailed by a sense

of inferiority (shyness) and by a desire to compensate for it by some means or other (showing off). When the management of the children has about it something of the aloofness and of the repression of former days, shyness and self-consciousness are apt to be the common faults. When, as today is clearly more common, the children are very well aware of their supreme importance in the eyes of their parents, we encounter this tendency, at all costs and by any means to concentrate attention upon themselves. In all four examples, the etiological factors are the same; yet, if the definition of hysteria set out above be accepted, the fourth example can hardly be regarded as hysterical. It may perhaps be compared to those cases of dermatitis artefacta, which are excluded from hysteria by Hurst and Babinski.

## (3)

## A COMPARISON WITH THE NEUROSES OF WARFARE

The similarity between the nervous disorders of children and certain war neurose is very close. It is not possible, for example, to read such a series of neurological studies as those issued from the Seale Hayne Military Hospital without being constantly reminded of similar experiences with little children. Especially are vomiting, stammering, enuresis, polliakiuria, night terrors and disturbed sleep, anorexia, phobias of all sorts, clowning and mutism common to both classes of cases. There are however certain points of contrast which are of importance in treatment. The child's home and his home circle may be regarded as a sort of culture medium, determining by its composition the form and growth of the child's mind. Symptoms of disturbance are due to faults of management, in most cases unrecognized by the parents themselves. It is through and by means of the parents alone that faults in the child can be permanently corrected. To remove the little child from his nursery to an institution or to another family circle is a step which can comparatively seldom be taken. Nor will it effect much that is permanent if the evil influences remain awaiting his return. To send into the home a nurse, who has paid some attention to the psychological side of child-training and who can demonstrate the cure by counter suggestion, is often effective but such women are hard to come by. In general, most is achieved by a perfectly frank discussion with the parents which demonstrates the dependence of the child's conduct upon suggestions consciously or unconsciously conveyed to him. To

estimate the nature and force of these influences from particular parents and nurses is a chief part of the work of a children's physician. To examine a child without an opportunity of making acquaintance with the mother is to be deprived of evidence which may prove essential for correct judgment. Fortunately nearly all educated mothers are quick to appreciate such points when they are raised. The dependence of symptoms upon suggestions derived from others has often only to be pointed out to be recognized. In many cases, a mother after a single interview of this sort has successfully overcome a hitherto persistent vomiting or enuresis.

The direct appeal to the child, on the other hand, the method of persuasion so successfully adopted with soldiers at Seale Hayne and elsewhere, in my experience has a much more restricted application. In the case of children, counter-suggestion must usually take the place of insistent appeal, with explanation and reassurance. Children at this age are apt to pay little attention to what is said to them; they are much influenced by what is said of them or even thought of them. If direct persuasion is attempted, the child is apt to resist and cry. Thus for example, the refusal of food, which is perhaps the most common of all neuroses in childhood, can be successfully combated only by a direct reversal of the suggestion. Among the well-to-do classes, anxious mothers, coaxing, urging and appealing, find persistent refusal. The child's reputation becomes firmly established as that of a strange child who has an inexplicable aversion to this or that essential food, or as one who seems utterly without appetite and to whom all food is a burden and a penance. Among the mothers of the poor on the other hand, to whom the cost of food is a consideration, nervous unrest in the child quite frequently shows itself in the directly opposite fault. Driven away from the cupboard, with indignant exclamations about his inordinate appetite, he returns again and again, apparently insatiable, clamouring for more. So remarkable a contrast gives us the clue for the symptomatic treatment of want of appetite and persistent refusal of food of the type with which we are dealing. Food must be doled out grudgingly. The suggestion to the child must be that the mother is constantly on the alert to prevent any excess being taken, while at the same time it becomes a subject for frequent comment in his hearing that his appetite is growing so rapidly that it is necessary

to be careful. In practice it is as easy to teach a child to conform to one suggestion as the other, if we can get rid of the mother's alarm and restore her peace of mind.

In dealing with these hysterical manifestations in childhood, it is very certain that success is only achieved by treatment which takes the form of this very elementary psychotherapy. To place treatment by drugs in the foreground, or to prescribe strict dietetic rules excluding a variety of common articles of food as in themselves capable of causing gastric disturbance is not only in general ineffective but, by increasing the mother's alarm and pre-occupation, tends still further to accentuate the symptoms. The symptoms truly have "resulted from suggestion and are curable by psychotherapy" and, let me add, by nothing else.

In conclusion, I would say that in making this comparison between the war neuroses and these little upsets of nursery life, which to some may appear too trivial to bear the weight of the attempt, I have been impelled by a desire to show that studies such as those carried on so successfully at Seale Hayne are not divorced from ordinary practice or without bearing upon it. They are valuable, not merely because they record the psychological phenomena of warfare, but because they make applicable to all forms of practice the experience gained from the unusual opportunities which the war provided. Here, as in many other branches of pediatric study, light may sometimes be shed by approaching the subject from the surer vantage ground of adult medicine in which, it may be, that etiology is less obscure and symptomatology more sharply differentiated. It is clear that the mind in development and in disturbed states in later life is prone to react similarly.

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ABRAMS' SPLENIC REFLEX (Riforma Medica, Naples, Aug. 28, 1920). L. Scalas writes that his attempts to elicit the splenic reflex, according to Abrams, in 9 children and 10 adults were negative, except in 5 children in whom there was a slight increase in the mononuclears and transitional forms compared with the count before and after the percussion of the spine. But in no instance was a febrile attack elicited, or the parasites appeared in the blood. It is possible, however, that the spleens were too pathologic to respond, as Cagliari is a hotbed of malaria.—*Journal A. M. A.*

# ARCHIVES OF PEDIATRICS

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## ORIGINAL COMMUNICATIONS

### A CLINICAL STUDY OF THE PREMATURE INFANT\*

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This study was undertaken to get a clearer idea of the management of prematurity. It is well known that both mortality and morbidity are higher in premature infants than at any other age. For this reason it seemed wise to analyze our own statistics on 77 premature infants. This is especially interesting at the present time, as, during the major part of 5 years, the management was

\*From the Department of Pediatrics, University of California Medical School. Thanks are due Dr. William Palmer Lucas, Chief of the Department, for the privilege of using the records of the Department for this study.

carried out in wards that did not have the best accommodation for premature infants as compared to the last 2 years, when we have had available a premature-room for the care of premature and very delicate infants. It is well known that the temperature equilibrium of the premature is very easily disturbed and that the factors of feeding and infection are most important in the management of these infants. These points are discussed in relation to our own experience with them.

Because of its unpreparedness to meet the conditions of extra-uterine life, the premature has always occupied a unique position among the new-born, calling for the utmost endeavor to over-balance this handicap. In it we have the problems of the new-born increased according to the number of weeks it falls short of the normal gestation period. The essential requirements of the premature—proper nourishment and the maintenance of body heat—have long been recognized, but the methods of dealing with them have undergone a decided change.

*Historical.* Breast milk has not always been considered the ideal food. Rotch (Rotch, Thomas Morgan, Pediatrics, 1st Edition), at one time, believed "that the best way to feed premature infants is by means of food carefully prepared at milk laboratories. This method of feeding premature infants is far superior to even breast feeding, and . . . will result in a decided reduction in their mortality." The advantages seen in this method of feeding were its sterility, properly balanced constituents, and ability to vary these percentages at will, in addition to which the infant could be fed without being removed from the incubator. The formula employed for a 28 weeks infant contained: 1 per cent. fat, 3 per cent. sugar, and 0.5 per cent. proteids.

It is now recognized that breast milk affords the infant the best possible nourishment; but when this is not available, the exact type of artificial feeding is still a matter of some dispute.

The various devices employed to conserve body heat are a tribute to doctors' inventive genius and form a necessary step in the evolution of the present day incubator room. To Doctor Tarnier belongs the credit for the construction, in 1880, of the first practical incubator used at the Paris Maternity Hospital. For the next 20 years, incubators were considered the best means for keeping the infant warm. Then followed the use of the padded basket and hot water bottles, a method which remains an



invaluable aid in the home care of these infants (McClanahan, H. M., *Management of Delicate and Premature Infants in the Home*, Jour. A. M. A., Nov., 1914, LXIII, 1758).

The points analyzed in this study are as follows:

*Maternal complications during pregnancy and their possible effect on infant mortality.*

*Length and character of labor.*

*Puerperium.*

*Age of mother and para.*

*Apparent causes of prematurity.*

*Length of gestation.*

*The average of birth weights.*

*Initial loss in weight and its relation to the birth weight; the day of first gain and the day of regaining the birth weight.*

*The weight at what would have been nine months gestation.*

*Length at birth.*

*The body temperature and maintenance of body heat.*

*Diseases of the new-born and other complications occurring during the first two weeks of the infant's life.*

*Complications occurring later.*

*The character of feeding and the caloric requirement.*

*Average residence in the hospital, with the gain or loss during residence.*

*Mortality.*

*Prognosis.*

#### MATERNAL COMPLICATIONS DURING PREGNANCY

The physical condition of the mother during pregnancy may be classed as: (1) negative; (2) having minor inconveniences, such as nausea and headaches—conditions incident to pregnancy but not being abnormal and having no effect on the child; (3) serious illnesses. Interest centers in the latter class with relation to its influence on the child, 29 of the 75 mothers being included in the group. Two of the mothers had twins making a total of 31 children. The physical conditions present in the third class, with the fate of the child, are shown in the following table:

TABLE I

Physical Condition	No. cases	Ch. lived	Ch. died
Toxemias .....	9	6	3
Syphilis .....	5	2	3
Tuberculosis .....	5	3	2
Nephritis .....	6	1	5
Heart Disease .....	3	2	1
Pneumonia .....	1	1	0
Multiple Arthritis .....	1	1	0
Neurotic .....	1	0	1
Total .....	31	16	15

*Toxemias of Pregnancy.* Under this heading are included those cases having a high blood pressure and disturbances of vision only during pregnancy, as well as the pre-eclamptic toxemias and the cases of true eclampsia with convulsions. There were 9 such cases with 3 infant deaths. In one case, the mother was having convulsions in the eighth month; labor was induced by the use of bags and the child delivered by version and extraction. Death, which was due to atelectasis, occurred in 7 hours. The second was also an 8 months child, weighing 1640 grams, who died on the third day. All the feedings were regurgitated and there was a question of pyloric obstruction or of toxic vomiting. No autopsy was allowed. Another mother, having convulsions, was delivered in the seventh month, the child bleeding from the nose and mouth. Death occurred in 26 hours and postmortem examination showed hemorrhages into the lungs, adrenals, and urinary bladder.

*Syphilis.* This accounted for 3 deaths in 5 cases, a mortality of 60 per cent. In one case, born at 6½ months and weighing 1960 grams, the lungs and liver were extensively involved. The second was a 7 months baby, born in the ambulance while coming to the hospital, and died a few hours later. The third died after a stormy 6 weeks in the hospital; it was fed breast milk entirely but was unable to take more than 40 c.c. at a feeding without regurgitating.

*Tuberculosis.* Two of the 5 children of tuberculous mothers died. One was a 6 months non-viable fetus; the other was admitted on the third day and died in 24 hours. It was extremely weak and had a severe epistaxis just prior to death; the mother died on the second day after delivery, which occurred in the San Francisco Tuberculosis Hospital. Reiche has previously pointed out that tuberculosis in the mother exerts a harmful influence on the premature infant even when the child does not show signs of the disease.

*Nephritis.* All of these infants died the first day; the weights in 3 cases were below the viable limit, being 500, 510, and 750 grams respectively. The fourth weighed 1840 grams but was extremely weak; death occurred in 15 minutes, and autopsy revealed atelectasis. The fifth case was born at 7 months; death was due to hemorrhages into the lungs, thymus, and adrenals.

*Heart Disease.* The single death in this group was due to acute intestinal intoxication which developed at the age of 13 weeks. The child was one of twins, discharged in good condition, but feeding instructions were disregarded in the home and 3 days later the child was returned to the hospital where it died in 42 hours. The mother had marked myocarditis and was delivered by caesarian section under local anesthesia.

*Neurotic.* This was a highly nervous Spanish woman; the child died on the third day and autopsy showed a perforate ventricular septum, acute bronchopneumonia, and absence of the right hypogastric artery. The temperature rose steadily to 40.2° C. at the time of death.

The mortality of this group is 48.6 per cent. As is shown in the discussion above, deaths were due to various causes other than maternal; yet the presence of these various conditions in the mother cannot but be a handicap to the child, whether it be an inheritance of the disease itself, as syphilis, or merely predisposing influences. The high early mortality bears this out, and if these children could be followed throughout childhood it is only reasonable to suppose that this already high mortality would be increased, particularly among those whose mothers had tuberculosis.

Nephritis seems to be the most serious single condition, with an infant mortality of 83 per cent. among 6 maternal cases. Syphilis ranks next, with a mortality of 60 per cent. Conclusions

from so few cases are apt to be erroneous, but they are offered for what value they may have in such a series.

Brown and George (Brown and George, *The Care and Feeding of the Premature Infant*, Arch. Pediat., Aug., 1917, XXXIV, 609) noted the maternal complications of eclampsia, toxemia, syphilis, insanity, nephritis, chorea, pernicious vomiting, intestinal obstruction, gonorrhea, and placenta previa, and are of the opinion that these "did not affect the infant mortality to any degree."

There was a total of 5 maternal deaths; 2 from pneumonia, one from tuberculosis, one from peritonitis, and one from an unknown cause. Three of the 5 children survived, one died 3½ hours after birth but had no connection with the mother's illness, as she died 24 days later of pneumonia. The child of the tuberculous mother died on the third day, 24 hours after the mother's death. This is the case referred to above in the discussion of maternal tuberculosis and was clearly attributable to that infection.

LABOR. The average time of the first stage was 12 hours, 45 minutes; and of the second stage, 1 hour, 12 minutes. Labor was normal in 40 cases; there were 9 breech presentations, 6 caesarian sections, and 4 of version and extraction—a high percentage of abnormal births. Eleven children died, of the 19 born following these abnormal labors.

PUERPERIUM. In this class, 47 mothers had a negative and 11 a febrile puerperium. In the latter group, 5 children died and 6 survived; of those surviving, the average day of first gain was 5.8, and the birth weight was regained on the seventeenth day. These figures correspond with those for the entire series; in fact, 17 days is 2.2 days less than the average. Six cases, of course, is a small number, but it is significant that a febrile puerperium did not have a detrimental effect on the growth and development of the child. The 6 deaths were due to causes other than maternal.

AGE OF MOTHER AND PARA. The average of the mothers was 28 years, 3 months, and the para 3+.

NATIONALITY. About one-half the total number of mothers were American born. There were: Americans, 30; hyphenated Americans, 5; Irish, 6; Italian, 2; Portuguese, 2; Swedish, 2; English, 1; Polish, 1; Greek, 1.

#### THE APPARENT CAUSES OF PREMATUREITY

The actual cause of premature labor is of more importance to

the obstetrician than the pediatrician, but becomes of importance to the latter when the maternal condition causing premature labor is such as to affect the prognosis of the infant. In the following table, the causes of prematurity are offered, not as actual but rather as apparent or possible causes, with the final outcome of the child noted.

TABLE II

Apparent Cause	Cases	Child Lived	Child Died
Not stated .....	33	25	8
Bleeding ... { Placenta previa { Prem. sep. placenta } .....	14	5	9
Nephritis .....	5	0	5
Toxemias of Pregnancy .....	8	6	2
Syphilis .....	5	2	3
Trauma .....	4	2	2
Heart Disease .....	2	1	1
Tuberculosis .....	3	2	1
Pneumonia .....	1	1	0
Alcoholism .....	1	0	1
Neurotic Condition .....	1	0	1
Total .....	77	44	33

The difference in the number of cases of toxemia, nephritis, heart disease, and tuberculosis, as shown in Tables I and II, is due to the fact that a serious physical condition of the mother was not always the most probable cause of prematurity. Thus, a case of nephritis might suddenly develop a premature separation of the placenta, followed by spontaneous or induced labor; it would therefore appear in Table II under the head of Bleeding, and in Table I under Nephritis.

It is significant that in 33 cases, or 43 per cent., premature labor occurred spontaneously or without any probable cause being discovered, and only 8, or 24 per cent., of the children died. In the 44 cases having some abnormality in the course of pregnancy or in the physical condition of the mother, the mortality was 57 per cent. Regardless of what may be the actual cause of death in

each individual case, the odds are better than 2 to 1 in favor of the child born with a clean health record.

Here again, nephritis ranks first. Maternal bleeding, including all cases of uterine hemorrhage, whether due to placenta previa, premature separation of the placenta, or other causes, was followed by infant deaths in 64 per cent. of such cases. There is suggested a significant relationship between these 2 conditions and the development of the fetus, possibly impaired nutrition due to a diminished blood supply.

#### LENGTH OF GESTATION

A majority of the cases were born after a gestation period of 7 or 8 months. The child born at 5 months might properly be considered a miscarriage, but inasmuch as it lived for several minutes it is included in this series. The youngest child to survive was born at 6 months, according to the history, although the birth weight was 1740 grams and length 41 cm. The feedings were pumped breast milk for 3 weeks, after which the child was strong enough to nurse.

Table III shows the number of cases born at the various periods, with the number that lived and died.

TABLE III

Period of gestation— mos.	5	6	6½	7	7½	8	8¼	8½	Undeter- mined
Child lived ..	0	1	1	12	3	18	3	2	3
Child died ..	1	5	4	12	0	5	0	1	4
Mortality ...	100%	83%	80%	50%		26%			

In some cases, the mother could not or would not give any definite date of the last menstruation, so they appear as undetermined gestation periods, which seems more accurate than to estimate the length of gestation on the basis of the weights and measurements of the children.

Where the number of cases warranted, the mortality has been shown. Nothing unusual appears, as with the increase in the length of gestation there is a corresponding decrease in mortality.

The average length of gestation was 7.34 months, or 31½

weeks. This is probably a shorter time than was actually the case, for the average birth weight was 1845 grams and length 42.4 cm., which is the size of the fetus at about the 34th week.

#### PHYSICAL CHARACTERISTICS OF THE INFANTS AT BIRTH

*Weight at Birth.* The average birth weight for the entire series was 1845 grams. Of those which lived, the average birth weight was 1986 grams; no accurate estimate can be made of the others, for quite a few were so weak that they were not weighed before death. Table IV shows a grouping of the weights, but here again the same error is evident, particularly in those under 1500 grams, as most of the cases not weighed would come in this group. Only 22 of the 33 cases which died were weighed.

TABLE IV

	Under 1500 grams	1500-2000	2000-2500	Over 2500
Child lived .....	9	11	15	5
Child died .....	8	9	5	0
Total .....	17	20	20	5

The smallest child to survive in this series weighed 1250 grams and was 38 cm. long. The initial loss was 130 grams; it began to gain on the fourth day and had regained its birth weight on the fifteenth day. The gestation period was 7 months; at the age of 2 months, which otherwise would have been at term, it weighed 2000 grams. This baby has been in the hospital 13 months, being allowed to remain on account of the very poor home conditions. A few weeks after being discharged it developed pneumonia, from which it is now recovering. The present weight, at the age of 15 months, is 6430 grams. This infant embodies many of the difficulties of the premature. Infections of the skin and upper respiratory tract were frequent in its early months, while a severe grade of anemia and moderate rickets developed later in spite of every effort being directed toward their prevention.

Three other infants which survived, born on the outside obstetrical service and subsequently admitted to the hospital, had birth weights of 1160, 1250, and 1260 grams respectively, but as

there was no confirmation of these weights a discussion of the cases is omitted.

#### INITIAL LOSS

It occasionally happens that an infant will gain from the first day without having the usual initial loss in weight, but this has not been the case with any of the premature infants. The average initial loss was 220.6 grams. They first began to gain at 5.7 days, and the birth weight was regained on the 19th day. (In 9 cases, the birth weight was not regained before the patient was discharged from the hospital.) In this connection, a comparison with the normal is interesting. Taking 3250 grams as the average birth weight of the normal full term infant, and 250 grams as the initial loss, the loss is seen to be  $1/13$  or 7.69 per cent. of the birth weight. The premature infants in this series weighed 1986 grams and had a loss of  $1/9$  or 11.1 per cent. of the birth weight—a striking increase in the proportionate loss. It is reasonable to suppose that the lowered vitality of the premature and the difficulty in feeding would result in a proportionately greater initial loss and delay in regaining the birth weight. Mention may be made of the fact that this is in conformity with Hammett's rule that the initial loss is, roughly, inversely proportional to the birth weight. In a grouping according to birth weight, this was found to follow through consistently, except for the larger infants; i.e., those weighing over 2500 grams.

TABLE V

Birth Weight	Initial Loss	Day of First Gain	Day Birth Wt. Regained	Initial Loss in Pct. of Birth Wt.
Under 1500 gms..	150 gms.	6.6	22	11.57%
1500-2000 gms....	190 gms.	6.1	19.4	10.31%
2000-2500 gms....	232.6 gms.	4.7	16.2	10.25%
Over 2500 gms...	316 gms.	6.8	25	11.71%
For entire series				
1986 gms. ....	220.6 gms.	5.7	19	11.1%

This group, of which there were but 5 cases with sufficient data, had the largest proportionate loss and were the slowest to gain. The other groups approached the normal as the birth



weight increased. The average weights for these groups were 1296, 1842, 2268, and 2698 grams respectively.

The smallest initial loss was 40 grams which was regained on the tenth day; this was a 7 months infant weighing 1660 grams at birth. The largest loss was 420 grams regained on the fourteenth day; this baby weighed 2300 grams at birth, which occurred after a gestation period of 8 months. Except for small initial losses of less than 100 grams, the amount of the loss apparently does not affect the time of regaining the birth weight. Those losing less than 100 grams (4 cases) regained the loss at 8.8 days; between 100 and 200, at 19.6 days; between 200 and 300, at 19.3 days; between 300 and 400, at 18 days. These figures are somewhat low because certain cases, discharged before the birth weight was regained, could not be included.

*Weight at Term.* In 17 cases, it was possible to get the infants' weights at what would be approximately term. The average of these birth weights was 1757 grams, and the weight at term 2090 grams; or a gain of 333 grams in from 1 to 2 months, the gestation periods being 7 and 8 months. We cannot expect a premature infant to gain as much in its first month or 2 of life as it would had it remained in utero, and the difference between 2090 grams and 3250 grams may be taken as a measure of but one of the handicaps. Since physical measurements occupy such an important position in estimating the vitality of a child, it seems not unreasonable to suppose that, being one-third behind its full term brother in weight, this fraction may also represent the handicap of its bodily functions and organic development. If the weight at birth of the surviving infants be taken as a measure of comparison, this weight being 1986 grams, the fraction  $1/3$  becomes  $5/13$ —an even greater measure of handicap.

*Length.* For the series this was 42.4 cm. The surviving infants measured 43.4 cm. and the others 40.1 cm. The shortest infant in the series was 31 cm. long at birth and survived.

#### TEMPERATURE

The infants born prior to July 1, 1918, 60 in number, were cared for in the old hospital building. This was not equipped with an incubator room; instead, the babies were dressed in the usual premature jacket and hood and placed in well padded clothes baskets with hot water bottles, similar to the method which must

be pursued in the home. This method has been fully discussed by McClanahan (McClanahan, H. M., *Management of Delicate and Premature Infants in the Home*, Jour. A. M. A., Nov., 1914, LXIII, 1758). Taylor (Taylor, R., *Treatment of Prematurity*, Jour. A. M. A., Oct., 1918, 1123) concludes that the optimum bed temperature is between 85° and 90° and on the average the baby will be able to control its body heat by the twenty-seventh day.

In recent years, incubators have received well merited condemnation because of their very limited air space and circulation. Cragin (Cragin, E. B., *The Sloane Hospital Incubator*, Jour. A. M. A., Sept., 1914, LXIII, 947) devised an incubator to overcome these objections, but the modern hospital, caring for a large number of infants, is now equipped with an incubator room.

The room at the University of California Hospital for the care of delicate and premature infants is 9 by 11 feet, with an 11 foot ceiling. It accommodates 5 infants, the cribs being separated by glass partitions 4 feet high extending 2½ feet out from the side wall. Entrance is through double doors so placed that the outer one is closed before the inner one is opened. A large window at the opposite end admits ample light, and a closet is provided for gowns and supplies. Furniture consists of a dressing table, chair, and scales. The ventilating system delivers 200 cubic feet of air per minute, thus affording a complete change of air every 5 minutes. A thermostat and hygrometer maintain constant temperature and humidity of the entering air. The room is kept at 80°, at which temperature the infants show an average daily variation in body temperature of .3° to .6°C. They may be as lightly dressed and covered as those in the nursery. The infants arrive from the delivery room with an average temperature of 36.1° C. and are placed beside the radiator, additional heat being furnished by hot water bottles if necessary. It is seldom necessary to keep them here longer than 24 hours, after which they maintain a fairly steady body temperature with the room at 80° and no additional heat in the crib.

The 60 cases cared for in the old hospital building by means of the clothes basket and hot water bottles had a mortality of 46.6 per cent. The remaining 17, having the benefit of the incubator room in the new hospital, had a mortality of 29 per cent. The improved method must have played a large part in this lowered

death rate, as other factors, such as feeding and exposure to infection, remained fairly constant.

The value of constant temperature was strikingly illustrated by a case not included in the present series, which was first seen at the age of 2 months. It was one of twins, born at 7 months, the other twin having died the first day. The mother had an abundant supply of breast milk, the baby was nursing well, but the weight remained stationary. Intelligent home care was being given after the manner of a full term infant. The only change made was to have the infant placed in a well padded basket, surrounded by hot water bottles, and disturbed only for nursing. An immediate gain in weight was noted and continued while artificial heat was gradually withdrawn.

COMPLICATIONS DURING THE FIRST TWO WEEKS

Some one or more complication was noted during the first two weeks in 28 infants, of whom 15 died. Hemorrhagic disease of the new-born and congenital atelectasis lead the list with a mortality of 100 per cent.; together they accounted for 10 deaths. Complications occurring later were mainly disturbances of nutrition and infections of the skin and upper respiratory tract.

TABLE VI.

SHOWING COMPLICATIONS OCCURRING DURING FIRST TWO WEEKS OF LIFE

	No. of Cases		No. of Cases
Diseases of the Newborn		Absence right	
Acute Infections		Hypogastric Artery.	1
Coryza .....	1	Absence Left Kidney..	1
Pustular Rash .....	2	Congenital Heart Disease	3
Bronchopneumonia .	1	Icterus Neonatorum....	16
Thrush .....	1	Cyanosis .....	20
Hemorrhagic Disease.	7	Miliaria .....	3
Ophthalmia .....	6	Syphilis .....	5
Ophthalmia, Neisser..	1	Disorders of Gastroint.	
Birth Injuries		Tract	
Caput Succedaneum..	1	Regurgitation .....	5
Asphyxia .....	5	Fat Diarrhea.....	1
Congenital Atelectasis.	7	Melana .....	1
Congenital Malformations		Anal Fissure .....	1
Club Feet .....	1		

TABLE VII.  
SHOWING LATER COMPLICATIONS

	No. of Cases		No. of Cases
Disorders of Nutrition		Coryza .....	1
Diarrhea .....	2	Vaginitis .....	1
Decomposition .....	2	Hernias	
Simple Inanition.....	3	Inguinal .....	1
Regurgitation .....	1	Umbilical .....	1
Infections		Intertrigo .....	1
Furunculosis .....	3	Convulsions .....	1
Otitis Media.....	2	Convergent Strabismus..	1
Thrush .....	1		

#### CHARACTER OF FEEDING

The feeding of these infants was made an individual matter and not according to standing orders; the amount and character of the feedings were prescribed daily. In general, the three hour interval was employed as early as possible. The very weak infants, taking only 10 to 15 c.c. at one time, were fed as often as every one to one and a half hours. The important thing seemed to be to furnish a high caloric intake without exceeding the limit of tolerance.

Breast milk in some quantity was available for all but 5 of the prematures, 19 receiving it exclusively. The remainder were given supplemental feedings of modified cow's milk. The mortality of these groups is interesting. Those receiving no breast milk suffered a death rate of 60 per cent.; those fed entirely on breast milk, 31 per cent.; and those on mixed feedings, 12 per cent.

Abt has pointed out that in using mixed feedings it is necessary to have at least 50 per cent. breast milk. Our experience agrees with this. At the present time, a premature infant, not included in this series, is receiving mixed feedings; and when the proportion of breast milk falls below 50 per cent., the infant does not thrive. When it has been impossible to use this amount of breast milk in our series, it was employed as far as possible during the first week of the infant's life, which is the most critical period. With these

precautions, and with proper supervision, we can say at least that, when necessary to employ supplemental formulas, we can do so knowing that it will not materially increase the patient's risk.

During the first 14 days, 45 per cent. of the infants were too weak to nurse. There was no absence of the sucking reflex, only insufficient strength to accomplish a satisfactory result.

The *caloric requirement* of the premature is high. The optimum, from our experience, would be approximately 160 calories per kilogram of body weight, although some gained on 120, while others required 200 calories to make satisfactory progress. High calories were obtained by the use of a high percentage of carbohydrates, mainly glucose in the form of corn syrup.

**AVERAGE RESIDENCE IN THE HOSPITAL.** Of the 44 surviving, residence in the hospital averaged  $7\frac{1}{2}$  weeks and a gain of 475 grams; 35 were gaining satisfactorily on discharge; 21 were on artificial feeding; 14 were nursing; and 9 were receiving mixed feedings. The daily gain of 9.5 grams is much less than that of the infant born at full term.

#### MORTALITY

There were 33 deaths among the 77 cases, or a gross mortality of 43 per cent.; 19, or 57 per cent. of the total number of deaths occurred on the first day. Of the remaining 58 cases, the mortality was 24 per cent. After the first 3 days, the death rate dropped to 15 per cent. The report of Taylor gives substantially the same figures for a series of 60 cases: gross mortality, 40 per cent. of which 58 per cent. occurred the first day. Of the remaining cases, the mortality was 22 per cent., and after the fifth day, 14 per cent. La Fétra (La Fétra, L. E., *The Hospital Care of Premature Infants*, Arch. Ped., Jan., 1917, XXXIV, 22) reports a series of 200 cases at Bellevue Hospital, of which 90 babies died on the first day; 28 on the second and third days; and of the 82 remaining, 30 lived to be discharged as of sufficient weight and strength to be cared for at home.

This appalling mortality of prematurely born infants has been brought out strikingly in comparison with the mortality of all infants. Holt and Babbitt (Holt and Babbitt, *Institutional Mortality of the Newborn*, Jour. A. M. A., Jan., 1915, LXIV, 287) have shown a general infant mortality of 3 per cent. among 9,571 living births. Prematurity was responsible for half of the deaths.

"Prematurity must, therefore, be recorded as the largest single factor in infant mortality of this period" (the first 14 days).

#### PROGNOSIS

Conclusions from the foregoing resolve themselves into the prognosis of the premature infant under given circumstances. Of first importance is the weight; other things being equal, an infant weighing less than 1500 grams has hardly an even chance for survival. The smallest survivor in this series weighed 1250 grams. Between 1500 and 2000 grams, there is an even chance or better; while above 2000 grams the prognosis is very good.

The length of gestation is the second consideration. Below 6 months, a fetus is non-viable; between 6 and 7 months the mortality is 80 per cent.; between 7 and 8 months, 44 per cent., or slightly above the gross mortality for all premature infants.

Infantile complications, especially those occurring during the first 2 weeks of life, very markedly reduce the chances for survival. In 39 cases, some complication was recorded; and of these 39, 25 or 64 per cent. died. Taking all the non-survivals, it was found that 76 per cent. had some complication, whereas but 32 per cent. of the survivals were so handicapped. The most serious were hemorrhagic disease of the new-born and atelectasis, in each instance being fatal. The mortality following syphilis and asphyxia was 60 per cent., while only one of 3 cases of heart disease died. Unfortunately, our hope of reducing this high death rate is slight inasmuch as these conditions, with the possible exception of syphilis, are not preventable or amenable to treatment.

Of far less importance in this connection are maternal complications. Among 37 such cases, 20 infants, or 54 per cent., died. Nephritis, pre-partum hemorrhage, and syphilis were the most serious. Following 24 abnormal labors, there were 14 infant deaths, a mortality of 58 per cent.; 28 per cent. of the survivals and 56 per cent. of the non-survivals were born after an abnormal labor.

As a final consideration, if an infant survives the first 24 hours, its chances are almost doubled; and after three days the mortality drops to 15 per cent. Whatever handicap there is in size, gestation period, infantile or maternal complications, will operate largely during the first 3 days of the infant's life.

*Bank of Italy Building, San Jose, Calif.*

## BLOOD TRANSFUSION VIA LONGITUDINAL SINUS WITH REPORT OF CASES.\*

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Transfusion, as a valuable therapeutic measure, still remains unappreciated. The ease with which the longitudinal sinus route may be employed and the simplicity of the technic are but too little understood. It is desired to emphasize the protean indications calling for transfusion, to discuss the availability and advantages of the sinus route, to detail technic, to point out the dangers and failures by this method as learned from personal experience, and to record the results of 13 transfusions done in this manner.

1. *General Indications for Transfusion in Infancy.* In spite of tremendous advances made in bacteriology, serology and in physiological and bio-chemistry, the etiology of most diseases still remains practically unsolved. By this is meant that the active ultimate agent, which, coming into the most intimate contact with ultimate body element, causes the change from normality to abnormality—the latter, together with the resulting perversion of function, constituting that which we call disease, still in the majority of instances, together with its manner of acting, remains shrouded in mystery. It is not sufficient to say that the pneumococcus causes pneumonia, that the Eberth bacillus causes typhoid fever, that the Koch organism causes tuberculosis. This is only the beginning. The exact nature and the manner of action of the toxins of these various organisms are even yet but little understood. Why one causes fibrin exudate in the air vesicles, the other having a selective necrotic action upon certain lymph areas situate in the small intestines and the last a coagulation and destructive digestive action upon all susceptible, particularly pulmonary and lymph tissues, is still not known and not soon likely to be. The proof of the insufficiency of the designation of a particular microorganism as the causative factor of a certain ensemble of symptoms, which we inadequately nominate as a certain disease, is given by the common human experience that the discovery of the germ is not immediately followed by the

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\*Read before the Philadelphia Pediatric Society, February 6, 1920.

destruction of that disease. This is because the organism is ubiquitous. Since we are unable to destroy it and, possessing a very meager knowledge or none at all as to its ultimate method of development in the body, and being still more in the dark as to the final method of interaction between it or its toxins or both and the tissues with which they come in contact, i.e. the ultimate etiology of the particular disease, we are helpless to stay its natural progress, ending either in the recovery or the death of the host. Therefore, whether we like it or not, we must acknowledge, at least to ourselves, that in the majority of the acute infections, we sit at the bedside helpless to assist in recovery, but often potent for harm by reason of meddling interference by means of rest disturbing measures! In truth, the same applies in principle as well to the afebrile diseases—those which result presumably from a slower but just as certain perversion in body chemistry—the so-called deficiency diseases—the ones dependent upon diet; for instance malnutrition, rickets, scurvy, eczema, asthma.

If now we are willing to acknowledge our inability to determine the etiology of disease as we now understand that term, we may assume, with a reasonable degree of assurance, that the causative agent or agents are carried to their ultimate sphere of activity by the blood—a compound nutritive circulating medium of extreme complexity which contains not only the elements which maintain nutrition and promote growth, but protective bodies, as well as those sinister ultimate etiologic factors of disease to which reference has just been made. We have long recognized the struggle for existence which goes on between these last 2 agents. The complete or partial ascendancy of the one over the other represents recovery or death or partial recovery. Hence, we may reasonably assume that the tide may be favorably turned by supplying the host with an extra amount of toxin or germ-combative agents. This assumption is not new but sera and bacterins, the modern therapeutic out-growth of it, except in comparatively few instances, are wanting in positive curative effect, for the reason that they represent an erroneous conception, or none at all, of the ultimate etiology of the particular disease. If this assumption be correct, even in spite of our unfamiliarity with the ultimate etiologic factors, we need not remain helpless until the decades have passed over our heads, but may, for the



time at least, resort to transfusion as a method to supply fresh healthy combative blood, representing the best anti-toxic and anti-microbial agent to date revealed to us. Thus perhaps may we treat many more diseases successfully by this method than at present we are doing. Further if used sufficiently early, may not the term "aborting," as applied to checking or cutting short of a well recognized malady, become a reality and not remain, as now, a chimera? Rather than expose myself to the criticism of radicalism or of becoming reactionary, by naming specific entities amenable to this form of therapy, I prefer to trust to your imagination to conjure up instances of diseases which may be amenable to transfusion.

2. *Availability of the Longitudinal Sinus.* The difficulty experienced in entering the veins of infants under 2 years of age and the ease with which they collapse have had a markedly deterrent influence upon the practice of transfusion at this age. In spite of the many ingenious methods devised by means of which transfusion may be successfully accomplished with this class of patients, nevertheless, it is done with extreme difficulty and requires special training and, usually, elaborate technic and apparatus. All of these may not be available when life may depend upon minutes or seconds uselessly employed in preparation.

It is known that the anterior fontanel remains open up to the 18th month. In many instances, it remains patulous even longer. This is particularly so in some diseases wherein conditions may arise which are particularly benefited by transfusion, rickets, for instance. The longitudinal sinus traverses this opening in the calvarium directly in the middle line from its posterior to its anterior angle. In the former situation, for all practical purposes, it lies just beneath the skin. Hence, it is readily available to puncture and may be pierced without danger to neighboring structures. So close to the surface does it lie that the danger from subdural or epidural oozing and subsequent coagulation is slight, because bleeding, after withdrawal of the needle, may be readily controlled by slight rotary pressure applied for 3 to 5 minutes.

The walls of the sinus are not rigid. Neither are they adherent to bony structures to such an extent as not to admit of considerable distention of the channel without rupture. Hence the

introduction of fluid, be it saline, sugar solution, salvarsan or other properly prepared medicament in solution or blood, becomes a matter of comparative ease.

The sinus route is available until the ossification of the covering membrane of the fontanel is practically complete—as long as there is a feeling of resiliency to slight pressure of the index finger or as long as cerebral pulsations can be detected. In fact, ossification may be pretty well advanced even before this pathway is no longer available. It may be used as long as it may be readily pierced by a needle. However, it must not be forgotten that bleeding, following withdrawal of the needle, is not so readily controlled by pressure when the covering membrane is rigid.

3. *Technic.* Four persons are needed to successfully carry out transfusion by this method—2 nurses and 2 physicians. In emergency, the thing may be accomplished with less and the idea not be abandoned because of lack of trained assistants. Team work, however, makes for success. In cases where hurry is not necessary, the procedure should be discussed previously by those who are to take part in the work. Each is assigned his or her duty, and he or she should rehearse it well in his or her mind. Then the whole should be enacted in pantomime by all the prospective participants together until there is no hitch. The director should be the physician in charge and all the rest must be submissive to his will and must be cautious to initiate no new maneuver, previously unknown to the rest, during the actual performance of the operation. Such an act may be fatal to a successful transfusion, though not necessarily fatal to the patient.

The infant's body is so wrapped that his limbs are immobilized much after the manner of preparation for tracheotomy. The infant lies prone upon a table of such a height that the operator, at its head, may work at ease and comfort while *sitting*. His hands, when resting on the table, must be about on a level with the anterior fontanel and under no circumstances must his position be cramped so as to cause him to point the needle from above or from below or from the side, but directly from in front of him. One nurse holds the infant's head firmly in the hollow of both her hands with fingers interlocked under its head. Hence, the head actually rests upon her hands and not upon the table. The palms of her hands are most advantageously placed over the infant's ears. In this position she has a certain leverage, which allows

absolute control of the head which she slightly flexes upon the chest. Her grasp must be firm and her hold steady. In one instance, temporary failure resulted from the fact that the nurse, unknown to me, suffered pain from sunburned arms. She was unable to remain still and moved during the most delicate part of the operation.

The other nurse acts as general assistant at the instrument table and passes the blood-filled syringes from the assistant physician, who is stationed at the side of the donor withdrawing blood regularly in 50 c.c. Luer syringes, to the operator who injects the blood into the recipient.

*Apparatus required.* Several needles, at least a half dozen of  $\frac{1}{8}$  inch bore. Each needle should contain within its bore a brass wire which must show at both ends to insure patency. A plugged needle may be discovered at the wrong moment and thus delay or spoil the entire procedure. The tips of the needle must be sharp but not too pointed and the flange must not be too long because the sinus lies so close to the surface that the tip of the needle may be within the lumen of the sinus before the opening in the needle is covered. This may result in subdural or epidural oozing.

In addition, there are needed a 10 c.c. Luer glass syringe and 2 or 3, 50 c.c. Luer glass syringes. The latter must be provided with special metal tips which will fit accurately into the needle which fits the 10 c.c. syringe. Sterile normal saline solution, sterile 1 per cent. sodium citrate solution, iodine, alcohol, rubber gloves, green soap, a good razor, rubber tubing to be used as a tourniquet on the donor, a couple of hemostats to hold the latter in place, gauze and cotton complete the list of necessities. The syringes and the needles are sterilized by boiling in weak soda solution and not by immersion in alcohol, otherwise coagulation of blood within the syringe or within the needle may ensue.

The area over the fontanel is shaved, although this is unnecessary. It is painted with iodine. The posterior angle of the anterior fontanel is accurately located by the index finger of the left hand. The 10 c.c. Luer syringe, with the needle attached, is partly filled with sterile saline solution. The tip of the needle is plunged just beneath the surface of the skin exactly in the middle line in the posterior angle. As the tip enters the lumen of the sinus, the fact is revealed by the appearance of blood

within the lumen of the syringe. Meanwhile the associate physician is filling a 50 c.c. syringe (Luer) with the blood of the donor. The physician at the head of the child keeps gently pushing and pulling the plunger of his 10 c.c. syringe in and out, thus preventing blood coagulation and keeping patulous the lumen of the syringe and the needle. A nurse meanwhile sprays ether or ethyl chloride upon the barrel of the 50 c.c. syringe into which the blood of the donor is being drawn. As this syringe is filled, it is disconnected from the needle which is allowed to remain in situ in the vein of the donor. The nurse passes this blood-filled syringe from the associate physician to the operator who disconnects his 10 c.c. Luer syringe containing the saline, allowing the needle, the tip of which rests within the lumen of the sinus, to remain in situ. This needle is steadied with the operator's left hand. The blood-containing 50 c.c. Luer syringe is quickly connected with the needle and the plunger is gently but firmly and continuously pushed home. Meanwhile, the associate physician at the donor's arm is filling with blood another 50 c.c. Luer syringe, previously washed out by the nurse with the sterile citrate (1 per cent.) solution. He finishes the filling of his syringe just as the last bit of blood has been delivered by the operator into the lumen of the sinus. The operator rapidly disconnects, hands the emptied syringe to the nurse as she passes him another 50 c.c. Luer syringe filled with blood handed her by the associate physician. This movement between the 3 must be harmonious. While both physicians are now preoccupied, one at the donor's arm and the other at the infant's head, the nurse is washing out quickly but thoroughly with the citrate solution the soiled syringe just handed to her. Thus this action between the 3 is maintained until 150 to 250 c.c. of blood have been injected into the recipient. The amount varies as the age and size of the infant, and as the severity of the case. Needles are withdrawn from recipient and donor. Bleeding in the latter is controlled by removing the tourniquet and by elevating the arm and by applying pressure for a few minutes over the site of puncture. In the recipient, rotary pressure is applied for a short period over the fontanel at its posterior angle. A bandage is applied and the infant returned to bed or sent home.

During the process of injecting, the operator may know that he is within the lumen of the sinus by the fact that no swelling

is raised. Should this occur, the procedure must, for the time being at least, be halted and taken up again on a later day. Usually no harm accrues to the patient, as I have witnessed even after a hematoma of considerable size had appeared, it was rapidly absorbed. But the process may not be repeated again with ease until all landmarks are again clear.

In 13 transfusions, done via the sinus route, I have witnessed no untoward or serious effects. In one case, a new-born, after about 80 c.c. had been introduced, the injecting syringe became clogged with a large hematoma, with, however, no serious results. The infant survived, and the case will be reported later.

In another instance the baby held its breath, became cyanosed and unconscious, and had slight convulsive movements. The transfusion was interrupted. At the time, the phenomenon was thought to be due to anaphylactic shock although the donor was the father. The local conditions at the site of injection were perfect and some 100 c.c. of blood had already been entered. Later it was determined, although it did not at the time appear in the history, that the child had had these attacks for the previous 2 months and that one was always readily inaugurated each time the infant became frightened or was crossed in any way. Later investigation revealed spasmophilia. Four subsequent transfusions were done on this baby. Breath holding, convulsions, unconsciousness recurred once or twice but they were not permitted to interfere with the transfusion. This patient finally recovered in every way.\* The improvement in its blood undoubtedly cured its spasmophilia. It occurs to me as to whether or not deficiency in the calcium of the blood, which must be a part of every severe anemia, the blood being reduced in this as it is in all its other elements, may not be responsible for this state of nervous excitability, which we term spasmophilia in this instance and epilepsy perhaps when it assumes a somewhat different aspect. Also, if this be so, may we not possess in transfusion a means of combating or at least improving these morbid states? My own experience, at least, seems to lend some color of truth to this assumption for in no less than in 6 or 7 instances have I seen cases of spasmophilia, in which anemia was a prominent feature, entirely recover, when the anemia was actively treated

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\* This child died a year later apparently from acidosis.

either by transfusion or by the continuous administration of arsenic and iron and proper food.

When conditions in the scalp are normal, the sinus, as stated, lies practically underneath the skin. Where, however, edema or swelling of any kind exists, this must be taken into consideration, when inserting the needle and the latter may have to be inserted a half inch or more before the point enters the lumen of the sinus. I have experienced this where the skin was swollen as the result of an ice bag burn. The operator must however be sure of his ground before plunging the needle deeply.

In very young infants or those whose heads are distended by hydrocephalus, the landmarks of the anterior fontanel are not always clearly defined. This is especially so where the size of the fontanel is unusually large. An imaginary line must then be drawn backward from the anterior angle and the needle inserted directly in the middle at a point about where the posterior angle may be assumed to be.

Sometimes the needle becomes plugged from coagulated blood and it is impossible to push the plunger of the syringe further. Another needle must be quickly substituted, care being taken that the second needle is accurately placed. The procedure then continues to completion.

The immediate effect of transfusion by any method is almost dramatic. The infant's tissues become suffused and glow with the ruddiness of apparent health. The ears, the toes, the finger tips, the nose, the lips and all visible mucous surfaces, before pale and blanched, become red and lifelike.

Immediate examination of the blood often shows a tremendous polycythemia, leucocytosis and sometimes over 100 per cent. of hemoglobin, i.e. all the blood elements are increased. During the next 24 hours the secondary effects become apparent. The infant becomes pale again, but not so pale as before, and microscopic examination shows a marked reduction in all blood elements. Gradually these again increase and the general outward appearance of the patient improves. This last may be designated the permanent effect and results no doubt from the stimulating effect upon the blood-making organs as well as from the destructive antitoxic and anti-microbic—in a word from the anti-etiological influence of the fresh blood.

There is often a rapid rise in temperature immediately fol-

lowing transfusion. The pulse becomes rapid and the urine shows heavy deposits of urates. These phenomena, however, speedily disappear. On 1 or 2 occasions, a small amount of air entered the blood stream apparently, however, without causing any ill effect.

I have transfused 14 children. Only those done via the sinus route\* will be described in some detail. The others will be briefly mentioned first, with the indication and the result designated.

Case 1. Nephritis with edema. Transfused twice. No result.

Case 2. Nephritis with edema. Transfused once. Splendid result.

Case 3. Lymphatic leukemia. Transfused once. No effect.

Case 4. Epidemic influenza. Transfused while patient moribund. Apparently prolonged life.

Case 5. Acidosis. Unconscious and moribund. Transfused once. Died.

Cases 6, 7 and 8. Hemophilia. Transfused each once. Recovery and marked general improvement.

H. McD., 18 months. Complaint, extreme pallor and bloody stools for nearly a year.

March 9, 1918. Hb. 30 per cent.; RBC. 2,460,000; WBC. 14,400; Pmn. 53 per cent.; SM. 47 per cent. Anisocytosis marked. Reds stain poorly. Careful study failed to reveal the cause either of the intestinal bleeding or of the anemia.

March 25, 1918. Transfusion via sinus route; 200 c.c injected at Mt. Sinai Hospital.

March 26, 1918. Temperature 100°, pulse 140, respiration 40. Paler than immediately after transfusion.

March 27, 1918. Hb. 50 per cent.; RBC. 3,800,000; temperature normal. Normal blood-free constipated movement—the first blood-free movement in months. It may be remarked that no more blood appeared in the stools while this infant remained under my observation.

April 1, 1918. 250 c.c blood injected via sinus route.

April 3, 1918. Hb. 65 per cent.; RBC. 4,740,000; WBC. 15,000; Pmn. 71 per cent.; SM. 24 per cent.; LM. 5 per cent. This child has still remained in health and appears ruddy and well.

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\* Since reading paper, some 15 or 20 additional cases have been transfused by this method.

J. L., 2½ years, Mt. Sinai Hospital. Nose bitten off by rat. Severe bleeding at the time. Marked secondary anemia. Also had bronchopneumonia and has rickets. Unfortunately blood records lost. Transfused twice via sinus route. Splendid permanent effect.

M. S., age 18 months, Mt. Sinai Hospital. Primary anemia. Hb. 20 per cent.; RBC. 1,960,000; WBC. 9,800; Pmn. 50 per cent.; SM. 48 per cent.; LM. 10 per cent. Anisocytosis and poikilocytosis marked.

May 25, 1918. Transfusion via sinus route, 200 c.c. injected.

May 27, 1918. Hb. 35 per cent.; RBC. 3,890,000; WBC. 14,600; Pmn. 43 per cent.; SM. 55 per cent.; LM. 1 per cent.; Mast. 1 per cent. (after first transfusion).

May 31, 1918. Hb. 40 per cent.; RBC. 3,270,000; WBC. 12,000; Pmn. 43 per cent.; SM. 53 per cent.; LM. 4 per cent. (before second transfusion).

June 2, 1918. Transfusion via sinus route, 200 c.c. injected.

June 3, 1918. Hb. 55 per cent.; RBC. 9,800,000; WBC. 12,200. Anisocytosis and poikilocytosis slight (after second transfusion).

June 29, 1918. Hb. 60 per cent.; RBC. 3,910,000; WBC. 12,200; Pmn. 88 per cent.; SM. 12 per cent.

G. H., 3 days. Hemorrhage of the new born. Bleeding from all mucous outlets. Horse serum and other organic and inorganic coagulants gave no relief. Pale and moribund. 80 c.c. of blood injected via sinus route and as much more under the skin as the operator had raised a large hemotoma at this stage and landmarks were destroyed. Infant appeared lifeless, save for its improved color. Heart action rapid but regular. Returned to bed. All bleeding ceased and did not recur. Hb. 20 per cent.; RBC. 2,200,000; WBC. 10,000; Pmn. 60 per cent.; SM. 39 per cent.; LM. 1 per cent.

On discharge April 1, 1919. Hb. 80 per cent.; RBC. 3,610,000; WBC. 8,200; Pmn. 51 per cent.; SM. 48 per cent.; LM. 1 per cent.

Baby J., February 6, 1919. Eczema, anemia, edema. Hb. 30 per cent.; RBC. 2,270,000; WBC. 8,700. Transfused via sinus route twice. 250 c.c. injected each time. Latest blood examination showed Hb. 73 per cent.; RBC. 4,370,000; WBC. 14,000. Present condition reported excellent in every way.

C. B., age 13 months. Extreme secondary anemia of unknown cause and spasmophilia. Transfused 5 times—4 times via the



sinus route and once via the median basilic vein. Her blood records follow: Hb. 30 per cent., RBC. 2,400,000; Hb. 45 per cent., RBC. 3,250,000; Hb. 58 per cent., RBC. 3,400,000; Hb. 36 per cent., RBC. 2,000,000; Hb. 41 per cent., RBC. 2,100,000; Hb. 53 per cent., RBC. 2,800,000; Hb. 63 per cent., RBC. 3,500,000; Hb. 78 per cent., RBC. 4,150,000.

In the beginning, this child showed marked anisocytosis and poikilocytosis. She had pica and intense spasmophilia. It will be noted that she suffered several relapses. She always did better away from home under the kindly firmness of a patient and skilled trained nurse. It was difficult to get her to eat while under home influence. Away from home her appetite was always better. She is at present in health.\*

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\* This is the case which died one year later apparently from acidosis under the care of another pediatricist.

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AEROPHAGIA AND VOMITING IN INFANTS (Journal de Médecine de Bordeaux, Sept. 25, 1920). Dargein fastened the infants' sleeves or hands to prevent their sucking fingers, and had an attendant watch two infants at a time during the bottle feeding so that the nipple did not slip out of the mouth; the bottle was also removed the moment the last drop had been taken. A little sodium bromid was given the more restless infants. By these means aerophagia was warded off, and there were no more "big bellies" among the infants. The infants that kept on sucking after the bottle was withdrawn were given a little more food until fully satisfied. Conquering the aerophagia put an end to the incessant vomiting of some of the infants, but others vomited with surprising regularity and tenacity until Dargein gave them one drop of 1:1,000 solution of atropin before each bottle. This arrested the spasm of the stomach responsible for the vomiting in certain cases. Those with putrid stools or diarrhea were given treatment according to the chemical findings in the stools. When there was evidence of a sluggish liver, with putrid stools, great benefit followed the use of abundance of kefir. The kefir proved life-saving also for several prematurely born infants with defective nutrition. The kefir was prepared in the institution.—*Journal A. M. A.*

## THE NERVOUS INFANT.\*

By D. J. MILTON MILLER, M.D.

Atlantic City, N. J.

At the present time one encounters frequently, and hears much about, the nervous adult and the nervous child; but very little about the father and child of them both, viz: the nervous infant. The success of Christian Science and the increasing number of osteopaths, chiropractors and the like, who batten upon the neurotic adult, bear testimony to the prevalence of the latter, who is the cause, as well as the result, of the nervous infant, the latter being not only not uncommon, but is at the same time the most troublesome, and often the most resistant case the pediatricist is called upon to treat. The picture is a familiar one: active, alert and wide-eyed, usually spoiled by, and the admiration of parents, relatives and attendants, who, especially the parents, are often as nervous as he, and who are perpetually exhibiting his brightness and cuteness to all who pass by; usually a poor and restless sleeper, tossing about or rolling or banging his head; inclined to spit up his food and with capricious or abnormal appetite; starting and jumping at the slightest sound; crying and fretting constantly, the smallest inconvenience or disturbance often inducing prolonged spells of crying, difficult to allay, and as difficult, frequently, to decide whether they are from hunger, colic or mere nervous irritability; afraid of strangers or of any unusual sight or object; hypersensitive of taste, refusing new articles of food, or detecting trifling alterations in his ordinary food; hypersensitive, also, to sound and color, as in a case of Guthries', where an infant of 7 months was thrown into paroxysms of fear at the sight of anything red; hyperesthetic as to the skin, hence prone to eczema, erythema and urticaria, and fretting inordinately, at tight fitting or uncomfortable clothing. This is the type of infant, also, who reacts unfavorably to the processes of dentition. In this category, further, may be included such affections as some forms of pyloric spasm and stenosis, nystagmus and head-nodding, head-banging and rolling, congenital stridor and cardiospasm. In addition, the neurotic baby is often intellectually precocious, talking and walking earlier than his more

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normal fellows, but rarely to the extent of the learned child of Lubeck, who is said to have mastered the Old Testament at 12 months (Guthrie). How different is this picture from the one presented by the normal infant, who cries only when hungry and uncomfortable, eats, digests and sleeps well, walks and talks at the proper time, cuts his teeth without disturbance, and grows quietly into a healthy and sane childhood, without other irregularities than those simple ailments incidental to his age and state.

The nervous infant is one who reacts abnormally to external stimuli. Frequently this is because he enters life with a deficient supply of nervous capital; he is handicapped from the start, and goes under when especial demands are made upon his stock of nerve force. This is the definition, also, of the adult neurasthenic, so that we may say that these infants frequently suffer from nervous exhaustion in the true sense. In other cases, the nervousness is acquired through unfavorable surroundings and attendants, such as over-attention, spoiling, dragging into picture-houses and into noisy shops and streets, in coach or go-cart, late into the night etc. Highly operative in the exhaustion of their nerve force is the continuous struggle that many infants have in order to live and grow upon food intended not for them, but for the young of the cow. This acts, also, in the purely hereditary cases; they would have gotten along fairly well, if they had not had this factor to contend against. In a word, imperfect nutrition is the most important etiological agent at work, and when it and an unfavorable environment are combined, the nervous infant is a common result.

Northrup relates an amusing and interesting case illustrating these points: a babe of  $4\frac{1}{2}$  months, the offspring of young, inexperienced and nervous parents, and nursed by a society-given mother, who attempted to both nurse the child and be socially active. Finally, the breast-milk deteriorated and the babe began to suffer; grew anemic and lost weight; at the same time, it was kissed, fondled, jumped into the air, and generally made much of by a host of doting relatives and friends. As a result, it began to spit up its food, was constantly crying and slept little, and was nervous in the extreme. The situation was becoming desperate, when a new nurse, a quiet, gentle, wise woman, took charge of the infant, who, in a quiet and secluded part of the house, by her comfortable and wise methods, got the exhausted and worn-

out infant to sleep, the first time in many weeks. From this time improvement began, vomiting gradually ceased and child slowly recovered. In an older infant, of 12 months, under my own care, who had suffered from early baby-hood from dyspepsia, or intestinal indigestion, and who was very precocious and unusually alert, with parents who were extremely fond of exhibiting his wonderfulness and his "cute stunts" but who spent half the night tossing about the bed from head-board to foot, fretting and crying out, yet showing no apparent harm on the ensuing day from his nocturnal spree, in this child very slow improvement was finally accomplished by methods similar to those employed in the case just related.

*Etiology.* To return to the rôle that imperfect nutrition plays in the production of the nervous infant: Attention should be called to overfeeding, whether by breast or bottle, and, particularly, in the artificially fed, to excess of fats and sugar in the dietary, a potent source of chronic irritation of the intestines and of nervous instability produced thereby. Rheumatism, or rather, the rheumatic diathesis, using that term to define a metabolic disturbance, and not a focal infection, is, I am assured, closely connected with the nervous temperament, and may be the cause of some of the nervous manifestations of infancy. I am persuaded, also, that states of sleeplessness by night and irritability by day, may be due to this cause, i.e., undefined muscular pains, or to a condition allied to scurvy, due again to a diet rich in carbohydrates and poor in vitamins and protein. Again, these infants are apt to suffer from hypertrophied adenoid tissue, frequently a cause of sleeplessness, and are subjects, often, of eczema and recurrent bronchitis, conditions which are believed by some to be due, in a certain proportion of cases, to deficient carbohydrate capacity, and which are closely connected with the rheumatic state.

*Treatment.* This must be begun very early, even with the great grandparents, to quote Holmes. In the schools, children should be taught the duties of parenthood, the girls especially, but also the boys. Nervous children must be placed in a proper environment and the routine of life regulated by the physician or other suitable and experienced persons. This is sometimes impossible, if the child remains in its own home. Morse relates a case when improvement was secured only when the parents

secured another home, some distance from their own, and installed the patient therein with a proper attendant, seeing it only once a week themselves. The growing child must also be taught self-restraint and must have plenty of exercise and air, proper supervision as to his several tasks, suitable food, a well-balanced ration, and a return to a simple dietary and to whole-grain cereals and bread stuffs, in place of the demineralized products so popular today. In a word, to avoid nervous babies, we must have children and parents sound of body and sane of mind.

In the management of the nervous infant itself, regularity is of paramount importance; the most rigid routine in all the activities of its existence must be maintained. There should be no infringement of the rule to feed at fixed periods, never mind how much the child laments; and the same rule is applicable to its bath and sleeping and stool hours. Nor should the sleep be permitted to be disturbed by wet diapers or unnecessary noises; a too quiet house and the going about with bated breath, because the baby sleeps, may be not out of place for healthy little ones, but not for the type we are now considering. By no means must the day-sleep be foregone or the evening sleep hour be postponed, with the hope that the night's sleep will be more restful. In the same way, all the surroundings of the child should be quiet, especially at feeding time, and the over-attention of fond relatives and friends discouraged. Normal infants may be treated with laxness in these things, but not the nervous ones. Quite frequently a wise, patient and sensible nurse is of more value than the doctor; and the mother is by no means always the best care-taker; indeed, she is quite likely to be the worst, her nervousness reacting upon the children unfavorably. Fresh air is good for these little people, especially sleep in the open, even in the coldest weather, provided they are properly clothed. But the feature of greatest importance in the management of the nervous type of baby is the diet, under-nutrition being the most active underlying cause. This may have its origin in the constant presence in the gastrointestinal tract of the products of imperfect digestion; there may be more or less continuous pain or discomfort, or the symptoms may be the expression of a general tissue hunger. Again must be emphasized the lessened ability to metabolize, and overfeeding with, the sugar and fats exhibited by, and too often practiced in, this type of child, whether on breast

or bottle. The starches do not appear to be so deleterious. Breast feeding should be insisted upon and assisted in every way. The belief has been already expressed that the so-called rheumatic diathesis bears an etiological relation to the nervousness of some of these infants, an additional reason for care in the use of the carbohydrates. As the babe approaches the close of the first year, and during the second, whole grain cereals and not demineralized ones should be added to the dietary. For the same reason, because of their mineral contents, the early use of green vegetables is advisable. It has seemed to me that in several cases of older, sleepless and nervous infants, improvement has followed the institution of a dietary of this nature.

Drugs have no place in the therapy of the nervous baby, except, perhaps, the occasional, moderate use of the bromides to meet special indications.

After all, the nervous infant is a difficult one to manage. Despite our best efforts, he too often remains nervous or develops into the neurasthenic child or adult. In this, as in other fields of medicine, prevention is better than cure.

*N. W. cor. California and Pacific Aves.*

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GALACTORRHEA (Policlinico, Rome, Dec. 13, 1920). In the case described by T. Luzzatti, colostrum began to flow from the breasts at the fourth month of the first pregnancy, and the flow kept up profuse until term. After the birth of the child the milk began to flow profusely, and this kept us for several months longer, a total of ten months of this annoying galactorrhoea, the incessant dribbling keeping the woman constantly soaked with milk. She seemed normal otherwise except for signs of hypertonia of the sympathetic system. Under astringent treatment of cracks in the nipples, glycerin with tannin with fomentations, with a support for the breasts, the dermatitis healed, and with it the mammary secretion subsided to normal limits and the woman could be considered cured. The irritation from the constant moisture had evidently maintained a vicious circle by reflex action, and the cure of the dermatitis had broken it up. Luzzatti does not know of any instance of colostrorrhoea in the pregnant on record.—*Journal A.M.A.*

## THE VALUE OF CALCIUM CASEINATE MILK IN FERMENTATIVE DIARRHEA.

By ADOLPH G. DESANCTIS, M.D., AND LILLIAN V. PAIDER, M.D.\*

New York.

During the summer and fall of 1920, we had occasion to see a great many cases of the fermentative type of diarrhea in infants. We adopted as a routine treatment in this type of diarrhea, the use of calcium caseinate milk. Casein calcium, a white powder, is composed of 97 per cent. casein and 3 per cent. calcium and is a substitute for the better known eiweiss milch of Finkelstein; that is, when added to whole milk and water, the final percentages of protein, fat and carbohydrate approximate those of eiweiss milch. We used  $\frac{2}{3}$  ounces of casein calcium, using that form commonly known as larosan, to 16 ounces whole milk and 16 ounces water, in which proportion, the percentages formed are fat 1.7 per cent., sugar 2.2 per cent., protein 3.4 per cent. It is well to use  $\frac{1}{3}$  milk,  $\frac{2}{3}$  water with casein calcium in infants under 4 months of age. The preparation of calcium caseinate milk formula is simple. Mix the casein calcium with 4 ounces of cold milk, bring 12 ounces of milk to a boil, then add the casein calcium and boil for 5-10 minutes, stirring constantly. Strain and add 16 ounces boiled water. No sugar is added to the formula.

As the title of the paper implies, we use calcium caseinate milk only in the fermentative type of diarrhea. Briefly, we classify all diarrheas as follows: simple indigestion, under which we include overfeeding and underfeeding; fermentative; putrefactive; recurrent; infectious; nervous and mechanical. In the fermentative type, there is the usual history of frequent green, watery, mucous stools, varying in number from 5-20 a day, acid in reaction, causing irritation of the buttocks, along with the other general symptoms of diarrhea; such as, elevation of temperature, irritability, restlessness, vomiting and loss of weight.

In all, we collected over 50 cases in which the following plan of treatment was carried out:

1. An initial dose of castor oil, unless it had already been given.

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\*From the Pediatric Department of the N. Y. Post-Graduate Hospital.

2. A period of starvation, varying from 12 to 24 hours, during which time nothing was given but water. The period of starvation was omitted in those babies with an acidosis in whom the starvation would have undoubtedly increased the severity of the condition.

3. The use of calcium caseinate milk.

4. No drugs except sodium bicarbonate to combat acidosis and the usual stimulants if needed.

In all our cases, we found that the stools diminished in number and became yellow and firm in from 2 to 5 days, the systemic symptoms clearing up in the same time. Undoubtedly, the high protein content, along with the low percentage of fat and sugar, is responsible for the good effects of the calcium caseinate milk. In the fermentative type, it is commonly known that the carbohydrate-splitting group of organisms are in excess in the gastrointestinal tract. Therefore, the ideal plan of treatment would be to give a food which is low in sugar (the food which that group of organisms thrive on) and high in protein. Calcium caseinate milk accomplishes this purpose. In our series of cases, we found it was necessary to use the casein calcium for from 5-8 days; we then stopped it and added dextri-maltose to the formula.

The following cases were patients in the infant feeding clinic:

*Baby A*—9 months old, weighing 9 pounds, 11 ounces, was having 13-14 green, watery stools, containing mucus and curds, daily for 1 week. There was fever at the onset and the infant was very restless, but for the past 2 days was very drowsy and slept a great part of the time, vomited occasionally and was rapidly losing weight; occasional cough.

The feeding consisted of raw milk 30 ounces, water 15 ounces, cane sugar 3 rounded tablespoons, farina, corn-starch custard, and orange juice daily.

Physical examination revealed a poorly nourished infant, dull appearance, pinched features, sunken fontanel, eyes sunken and half opened, dry coated tongue, acetone breath, scaphoid abdomen, intertrigo, wrinkled skin that showed the effects of lost weight, rapid deep breathing, and on auscultation a few râles were heard at the bases of the lungs posteriorly; otherwise physical examination was negative. The temperature was 98°, taken



at 11 A.M. Diagnosis was made of fermentative diarrhea with acidosis standing out as a prominent symptom.

We put the infant on calcium caseinate milk, using  $\frac{2}{3}$  ounces casein calcium to 20 ounces milk, and 20 ounces water, no sugar, giving 5 feedings, 8 ounces every 4 hours. All other foods were forbidden. Plenty of water was allowed between feedings. Medication consisted of sodium bicarbonate grs. xv by mouth every 4 hours and strychnine sulphate, gr.  $\frac{1}{360}$  t.i.d., given 20 minutes before feeding.

On the day following the use of calcium caseinate milk, the infant had 3 stools and on the day of visit to the clinic there were 2. The stools had become yellow and much firmer, so that on the second day they were normal. There was a gain of 1 ounce, no vomiting, and the general appearance of the infant seemed somewhat improved. The temperature was  $98.8^{\circ}$ , taken in the afternoon. The same treatment was continued. After 5 days use of calcium caseinate milk, the infant was having 1 yellow, firm stool, no vomiting, took all her food and cried for more, slept better, gained weight. The same formula was continued, but we told the mother to discontinue the medication. The infant continued to improve, so that on her visit to the clinic at the end of a week's treatment, she had gained 1 pound, 3 ounces, was bright and active, slept well, was hungry, and had no stool at the time of visit to the clinic on that day. The casein calcium was discontinued and we began to increase the formula, adding dextri-maltose.

*Baby T* was 3 months old and weighed 11 pounds. For about 3 days the infant was having 10 green, watery, mucous stools, was feverish; was not taking all his food; slept poorly; and was irritable and fretful all day. The feeding history consisted of raw milk, water and 3 tablespoons cane sugar.

Physical examination revealed a moderately well-nourished infant, crying and fretting; accentuation of the nasolabial lines of the face; and excoriations about the buttocks; otherwise physical examination was negative. The temperature was  $100^{\circ}$ , taken at 2 P.M. Diagnosis: Fermentative diarrhea.

We put the infant on calcium caseinate milk, using  $\frac{2}{3}$  ounces to 12 ounces milk and 24 ounces water, gave 7 feedings, 5 ounces each, every 3 hours and sodium bicarbonate grs. x every 4 hours.

The next day the infant had 3 stools, greenish-yellow and

firmer, was hungry, slept a while during the day and was not so fretful. Temperature 98.6°. Treatment was the same. The following day the infant had 2 yellow firm stools and slept better. From this day on, there had been 1 or 2 normal stools daily, no vomiting, child took all his food and cried for more, slept well. On the fifth day after treatment, the calcium caseinate milk was discontinued, the formula was increased but dextri-maltose sugar was not added until at the end of one week.

We wish to express our thanks to Dr. Roger H. Dennett for the permission to use the hospital records.

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REMOVAL OF ADENOIDS IN INFANCY (The Practitioner, London, November, 1920). Tod states when removing adenoids under the age of 6 months, especially if the baby be undersized or ill-developed, a general anesthetic is neither required nor advisable. The infant is held in a sitting position by a nurse, a small curette is passed up behind the soft palate into the postnasal space and brought down with one sweep. Owing to the small size of the postnasal space, it requires but a tiny pad of adenoids to give rise to symptoms, but in some cases one is surprised at the amount of adenoids removed. As a rule, very little bleeding takes place, and there is rarely any shock, but the infant should be kept warm, and if there appears to be any shock, should be given a drop or two of brandy in a little milk. It is advisable not to feed the infant for 3 hours before the operation takes place, so that it can be given the breast or bottle within ten minutes or so after the operation has taken place. He has frequently performed this operation on infants, the youngest of which was but 3 weeks old, and he has never observed any harmful results in consequence. On the contrary, almost immediate benefit will be noted, as the child soon begins to breathe normally through the nose and to suck with comfort; otorrhea and bronchial symptoms, if present, rapidly disappear, and the weakly infant thrives and becomes strong. For these reasons, he strongly urges that adenoids should be removed, no matter how young the infant may be, whenever they give rise to any symptoms which may adversely affect its immediate or future welfare.—*Therapeutic Gazette*.

## THE NUTRITION CLASS IDEA—A RETROSPECT AND A PROSPECT\*

By FRANK HOWARD RICHARDSON, M. D.

Assistant Pediatricist and Chief of Children's Clinic,  
Brooklyn Hospital.

Our social service chief has given me this opportunity of coming before you again, to tell those of you who have not yet attended our Saturday morning Nutrition Class sessions, just what they are and what you are going to make it possible for us to make them this coming year.

You are all more or less familiar with the broad facts underlying the Nutrition Class idea—easily the most fascinating of all the present day efforts that combine medical and social work, and yet still in its infancy and relatively unfamiliar to those who need only to become cognizant of it, in order to become enthusiastic over its possibilities and its accomplishments. Roughly, the facts are these: One-third of all the children in the United States are at least 7 per cent., and many of them 10 per cent., and even much more than this, below the weight that is normal for their age and height. This condition, with all that goes with it of lowered resistance, mental retardation, etc., cannot be remedied until the underlying defect that is contributing to it, such as diseased tonsils and adenoids, carious teeth, etc., has been discovered and remedied. For the detection of all of these defects that may exist in a given child, a complete, searching physical examination is necessary. It is comparatively easy to find out these defects, but very, very hard to bring to bear sufficient and suitable pressure to have them removed. Given their removal, and the institution of a proper health regimen and an adequate diet of suitable character, practically all of these children can be made to gain up to or beyond the weight normal for their age and height. Failing these prerequisites, so-called tonics, like iron, cod liver oil, "blood medicines," etc., are powerless to produce this gain, and are worse than useless, in that they upset digestion and destroy appetite, instead of doing what they are supposed to do. And, in conclusion, the class method, long ago found most successful in meeting the tuberculosis problem, is the most rational and satis-

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\* Read before the Social Service Committee of the Brooklyn Hospital, May 25, 1920.

factory way in which to cope with this great menace of undernourishment.

In our own hospital, a staff consisting of a social service expert, 3 doctors, and from 1 to 5 volunteer aides\* has assembled in the dispensary building every Saturday morning, since the new department started out last fall, to work upon as many of the 80 children enrolled among its records as chanced to appear each day. These children were supposedly well, but were all far below par in weight, physical well-being, and stamina. Many or most of them had been treated by family doctors and clinic doctors, without much improvement, if not with steady loss. Each of these children has been carefully interrogated as to his past history by a volunteer aide, and a careful record of the facts made. Each has been given as searching, minute a medical examination as we have been capable of performing. Each has had his physical condition fully charted on the blank you have before you, and the defects thus discovered grouped in the lower left-hand corner of the sheet, together with the doctor's recommendations for their improvement or cure. As many of these defects as we could persuade the children, or their parents, to have corrected, have been removed. Each child has been instructed, by every worker and in every way and from every angle possible, in the means of bettering his health. We have stressed the importance of proper food, cleanliness, care of the teeth, daily naps, frequent small meals rather than fewer heavy ones, fresh air, and everything else that we could conceive of. Appeal has been made to their fondness for rewards, their love of competition, their pride in themselves and in their records, with the most encouraging response. Every one has been visited at his home, at least once, by the nutrition worker. And every one of these youngsters, we truly believe, is a better embryo man or woman for the faithful, painstaking work that has been done for him. I need not take time telling those of you who have watched them there, how they enjoy their sessions. Every one of them is far ahead of what he would have been, had he not been a member of the Nutrition Class. And, most significant fact of all, not one of them would or could have been affected to an equal degree by any other agency at work in this or any other city, for there is no other agency equipped to deal with these undernourished youngsters, with the combined force of

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\* Now 6 doctors and 8 volunteer aides.

medical examination and diagnosis, surgical treatment (where necessary), expert social diagnosis, and boy-scout-like personal and family appeal. And not one single solitary pill or drop of medicine has been given!

Dr. Donnelly, chief of the Nutrition Clinic, is presenting a preliminary report of the results of the work, before the Kings County Medical Society next month <sup>1</sup>, <sup>2</sup>. I am contributing to this report a section that deals with the things that we did wrong last year, which are things that we are going to do right, this coming year. I don't want to admit that we did anything wrong, but we did do many things in other than the very best way. For instance, in spite of the warnings of Emerson, who began this work in Boston a number of years ago, we started in without the assistance and guidance of a trained nutrition worker. We never had even the full time of a social service worker. After we had worked Miss T. (who used to sadly admit that she was much more than 7 per cent. underweight for her age and height!) into a nervous collapse, and before our present worker came to us, we staggered merrily along for some weeks without any worker at all, and the number of 1 visit cases increased in a way that we don't like to think of. Our 3 doctors were completely occupied (or should have been) with strictly medical work, so that the time spent by the children and their parents in the waiting hall was more pandemonium than health propaganda; a golden opportunity thrown away, because of inadequate staffing. We had no printed diet slips or instruction leaflets, and writing out directions by hand, and repeating them over and over again to impress them clearly, is a costly process in time and energy. We might have reached 300 children easily, instead of touching 80 with difficulty, had we been able to apply in practice the smoothly running system that we devised in theory. We might have had the whole weight of your committee back of us, heart and soul, had we realized that you would let us come to you and meet you and talk over with you our problems, and get your help in the lines in which we were unsuccessful.

This summer, during the school vacation period, we shall probably refer to the General Medical Pediatric Clinic any cardiac

<sup>1</sup> Donnelly, W. H.: *The Class Method of Treating Malnutrition in Children*. N. Y. Med. Jour., Dec. 18, 1920. Vol CXII, 25, p. 973.

<sup>2</sup> Ruderman, Louis M.: *Six Months' Experience with a Nutrition Class*, *idem*. p. 976.

or nutrition youngsters who need special attention. But in the fall, we shall start out upon our second year of existence, with all the experience gained in the first, and with fresh interest and vigor. We are going to have one of our staff of workers come before you, just as often as you will let us; and are going to be, with your help and backing, just as great a factor in improving the health of the child life of the community as it is possible for us all, working together, to be. The most urgent of our needs we want to put before you now, so that we may all be thinking of them this summer, and planning how they may be met, in the fall.

First of all, we need a full-time social service worker for the Nutrition Class, which includes in its scope the Cardiac Class. Our present worker can tell you how she is torn asunder by the claims upon her time and interest of the various departments of the work—feeding clinic, sick children, well babies from maternity, cardiac, and nutrition—and how inadequate one person must be to attempt to meet their manifold needs in the 24 hours of the day. Personally, I can conceive of this nutrition work without a doctor; I can not possibly visualize it as continuing, without a social service worker!

Our second need is for a committee from your number, to co-operate with the doctors in planning and providing for a definite, consistent program of health education, lectures and entertainments, for Saturday mornings of our entire season. These should comprise such prosaic affairs as health talks, both by our own nutrition doctors, and by such allies in the game as Dr. McKenna from the Orthopedic Department, someone from the ear, nose, and throat department, a dentist, etc. The social service worker can present a side of things that we miss; the hospital dietitian could approach things from yet another angle. The New York State Department of Health has promised us the use of their movie films, which could constitute a special monthly feature. Cho Cho, the Health Clown, and that delightful Health Fairy, might be engaged for special events; even a Health Santa Claus might not be beyond the histrionic abilities of some of us, once in the year. With such a series of interesting and instructive things as these, keeping mothers and children waiting long enough for the necessary weighing and examining will be no problem at all; we shall have eliminated the great waste of time of the dispensary waiting

room, substituting health instruction for boredom; and shall have at hand an incalculably valuable means of driving home the health and nutrition points that we want impressed and emphasized.

Third, we need an exhibit, in wax, of various articles of food that we can recommend, showing their relative values and amounts. We hesitated about starting the work without such an exhibit; but having seen dispensaries that had such exhibits and no Nutrition Classes, we decided to see, if it were not possible to have a Nutrition Class, even though we were to have at first no food exhibit! It will, however, make our work much easier and much more valuable to have one, and I am confident that it will come soon.

Our fourth need is for a group of volunteer aides, at least 6 in number, who will definitely take over certain phases of the work, so that the doctors may be left free to do the strictly medical work, and the social worker can function along her own special line. Two of these girls weigh and measure every child each time he visits the clinic, award the proper colored seals to which each child's gain in weight, faithfulness in attendance, or observance of rules entitles him, and sends him back into the waiting hall by the opposite door, where he can enjoy the entertainment provided until he is summoned in turn before one of the doctors. The latter occupy rooms opening out from the side of the hall; one is for the examination of new boys, one for new girls, and one for re-visits of both sexes; for it is only upon the initial visit that the child must be completely undressed for a complete examination. At these return visits, the doctor comments upon gains, ascertains the causes of failures to gain, and gives such suggestions as may be indicated. Each of these rooms is in charge of a volunteer aide, who, by keeping a constant stream of children ready for the doctor, and acting as his amanuensis, can easily double the greatest amount of work that he could possibly accomplish unaided. Another aide (either Miss Chapman or one of the girls that she will have trained along this line), will handle all records, so that no one shall be allowed to tamper with her wonderful filing system, that is getting to be one of the show features of the dispensary. We shall want one aide to take a Kodak snap of each child on admission. Last of all, there should be someone with an ability for generalship such that she can keep this whole complicated ma-

chinery running smoothly, so that we can minister to the greatest possible number of parents and children in the limited amount of time that we can devote to the work.

Starting out with these things, our class of last year will be to that of the coming season as moonlight is to sunlight. Instead of stopping at 80 children, as we have been compelled to do, we shall be able to take in all the children that come to us. Instead of refusing even the specially needy cases that Mrs. Merriam has been begging us to take in, we shall urge her to send us every child she can find who needs what we have to offer. We shall have the admitting aide, who weighs and measures all cases in the General Pediatric Clinic, refer to us automatically every child whom her weighing and measuring show to be 7 per cent. or more underweight, so that we can coöperate with the doctor who is treating the illness, and keep on with the youngster after the immediate illness is over. We can do this, because the doctors will be doing only medical work; the social worker will have her hands free, and can seize the golden opportunity to have a word with this father or that mother who is present for the day; and each aide will be doing her own piece of work, for which she alone is responsible, and which she has learned to do better than any one else can do it. The parents will be linked up with the work of the class, and they and the children will be held by the interesting things presented them in the waiting hall by the educational committee. Were we to plan a building exclusively for this work, we could hardly make it different from the one we now occupy, with its ideal hall, lighted from the top, for lectures and demonstrations; the big room at one end, communicating with it by 2 doors, for weighing and measuring the children, taking them from and returning them to the hall in a steady stream; and its series of examining rooms along the sides, into which the medical aides can sort the proper cases to be seen by the respective doctors.

As soon as we can accomplish it, there will be additional doctors in rooms now vacant, to handle the subclasses into which such a large range of cases must be divided, in order to get the best results. There must be the doctors of the cardiac class, already in existence; one or more for the pretubercular class, which must soon be formed; and as many as are necessary for the health class, into which all nutrition cases proper graduate, with some little cere-



mony, as soon as they have had all their remediable defects corrected, and have come up to the normal expected weight for their age and height. All these, and their parents, can use in common the central hall, where a health educational campaign, appropriate for them all, will be going on. If we are to do our full duty by these children, all of them must be protected against smallpox by vaccination; against diphtheria, by the toxin-antitoxin administration that we are giving to our private cases (where the Schick test shows the individual to be susceptible); and against typhoid, by the anti-typhoid inoculations. It may soon seem advisable for the various allied departments each to furnish us a representative from its staff, so that the diagnosis of teeth, tonsils, lurking nervous disease, eye-strain, or orthopedic conditions, like spinal involvement or flat feet, may be made by experts, and defects detected that would otherwise go unnoticed, to militate against the child's climb to health. Already we have under way such a relationship with the department of ear, nose and throat; and the others should soon follow suit.

Just one word more. I wonder whether, as I have been talking, there has occurred to any of you the conception that has gradually been taking shape in my mind—namely, of the Nutrition Class as a possible solvent of many of the puzzling hospital, medical, and social problems of the day. Group diagnosis, as practiced at the Mayo Clinic in Rochester, Minnesota, and, less elaborately, all over the Middle West to-day,—we have it, in our adjoining rooms occupied by specialists in everything medical and surgical and social that affects children. A Diagnostic Clinic for the group study of children,—I know of nowhere that this has been attempted upon so comprehensive a scale. A Life Extension Institute,—we have one, in our searching history and comprehensive physical and mental examination, completed by the appropriate laboratory tests and x-ray examinations that we can and do call for. Closer organic relationship between hospital and dispensary,—we have that in the transfer of ward patients to the Health or the Nutrition Class, instead of their discharge on leaving the hospital. Proper staffing of the dispensary, and the remuneration of the physicians working there,—we have both, in the multiplied opportunities for study, observation, and teaching afforded to both general practitioner and specialist in this detailed study of large numbers of children in comparative health as well as in the incipient stages of

disease. Health education for the people,—we have that, too, in our health talks and demonstrations to parents and children, 52 times in the year. The single record, or the central records office, about which we hear so much in discussions of the problems of hospital administration,—you have the working out of that, in the chart before you, on which every person who comes in contact with the child, either at the initial examination or at a later date, records the results or findings of his study. Better relations between medical and social forces,—can you conceive of a closer working relationship than what we have outlined above, as having been found indispensable for obtaining the best results? Greater efficiency at the least unit cost,—the Nutrition Clinic is run almost entirely by volunteer labor; it has no drug room, and is unalterably and incurably opposed to tonics, cough mixtures, and “placebos,” and it occupies the dispensary building at an hour when it would otherwise stand vacant, thus bringing a larger usury upon the investment locked up in the plant! The curbing of specialism run rampant,—we have even that, in the absolute intercommunication between rooms, where each doctor takes, instead of referring, his patient from one special department to another; the resulting diagnosis being the outgrowth of a complete, concerted study, rather than of a series of consecutive, unrelated snapshots.

This, then, is the “Nutrition Class Idea.” No child must ever be able to say that he was told at the Brooklyn Hospital that he was “cured,” so that he need not come back for further observation and treatment. Our doctors must never be “through with” their children. Our rule is to give every child, or his mother for him, an appointment for some future date, however remote, at which time a postal card or a visit will jog his memory, if he fails to appear. Detection or correction of defects, or protective inoculations, can then be attended to. Either the health class or the nutrition class must lay its snare for every child discharged from the wards of the hospital. Like the demon rum, we want to create in our victims an incurable habit,—“the Health Habit,”—which they simply cannot throw off. We want this habit to become so ingrained as part of their lives, that they can never slip into the diseased class whose ranks are recruited from the ignorant and the careless. And we of the Brooklyn Hospital shall have set in operation a force which can never be checked,—so vast a

thing that one hardly dare attempt to compute its value to the individual, the city, and the nation. A citizenship 100 per cent. healthy,—can you conceive of it!

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POSTOPERATIVE MORTALITY OF APPENDICITIS, ESPECIALLY IN CHILDREN (The Lancet, Jan. 15, 1921). Herbert M. Brown emphasizes the great importance of operation at the earliest possible moment after the commencement of the attack, preferably during the first 24 hours, while the infection is confined within the appendix. But when the patient, a child, is seen for the first time by the surgeon during the third, fourth, fifth, or sixth day, when the infection has spread beyond the appendix and a localized abscess is formed, the alternatives are immediate operation or delay until the second week (when there is considerable immunity to blood infection). He thinks the safer, though certainly not easier, course is to wait, although if anything untoward results the surgeon will probably be blamed for his Fabian tactics. Appendix abscesses very rarely burst into the peritoneal cavity if the patient is kept at rest in bed, on scanty and easily absorbable diet, and the bowels are not disturbed by aperients. During the second week the abscess may be opened and drained with the minimum of danger. But if it is decided to operate at once during the dangerous period it is absolutely essential that nothing but the introduction of a drainage tube into the abscess cavity should be attempted, with no swabbing, no handling, no interference of any kind, and, above all, no removal of the appendix. The latter may be safely done many weeks later when all infection has subsided. The great danger of blood infection occurs especially in children; adults appear to have a far greater power of resistance, but to them, too, the same rule should apply. In cases where there is general peritoneal infection, when the appendix is perforated or gangrenous and free in the abdominal cavity, it should always be removed with as little disturbance as possible, and free drainage to the bottom of the pouch of Douglas with a large drainage-tube, provided, of course, with the Fowler position. It is not justifiable in such case to delay operation, at whatever stage of the disease the patient is seen.—*Medical Record*.

## THE ELIMINATION OF TREPONEMA IN CHILDREN BY MERCURY INHALATION.

BY J. LEWENGOD, M.D.

Attending Physician, Hebrew Orphan Asylum, New York City.

In my capacity as physician to the Hebrew Orphan Asylum, where we have about 1200 children of both sexes, between the ages of 5 to 14 years, it occurred to me, about two years ago, that, the taking of a Wassermann test was a necessity to insure their future; and, in May, 1919, I inaugurated this plan. These children are mostly of unknown antecedents, or of doubtful history, so that it was impossible to diagnose an inherited lues without a blood test.

From May 16, 1919, to June 19, 1920, thirteen months, I took 1459 Wassermann tests. These include new admissions, and I was rather astonished to find only 33 cases which showed a positive Wassermann, less than two per cent. Of these, ten were 4 plus, six were 3 plus, and seventeen were 2 plus. Of course, I realize that as these children were all asymptomatic, that some of them, especially the one plus cases, were doubtful cases of lues, but that all who showed any spirochetes whatsoever, in the blood, were entitled to treatment for their removal, was evident. But what treatment to follow with these small children was a problem!

As I had been experimenting with a new mercurial preparation for a couple of years, in adults, I decided to try it in these children, with the following results: This preparation, spirocide (mercupressen), is given by fumigation and inhalation, a method, both easy and convenient, requiring no apparatus, and giving the children no pain or trouble whatsoever. This preparation consists of a tablet of pure metallic mercury, copper, and vegetable matter (formula public) and burns readily with complete volatilization of the mercury. It is given by simply lighting the tablet and placing a sheet over the child's head, like a tent, and allowing the fumes to be inhaled, bandaging the eyes to avoid smarting. This takes about 15 minutes. The children receive the fumes from one half of a tablet, daily, until six are taken, which usually produces the result required. In the 4 plus cases, several more were given, in most cases nine altogether; and, in one case, twelve. There is no way of measuring the quantity taken, and the cases must be watched for

symptoms of salivation. But, whether on account of the combination in this preparation, or the tolerance of the children to mercury itself, no case of the 33 was salivated. Of these, 32 were negatived, with six treatments, and only one resisted and required 12 treatments, and now, at the time of this writing, March, 1921, none has returned positive, and all are well.

Since June, 1920, every new admission to the Asylum has been Wassermannized, with several more cases of plus Wassermann showing; but, as these are rather recent, I will not report them, at this time, but will later give a detailed report of all cases treated.

Only one case, a boy of 15, graduate of the Hebrew Orphan Asylum, showed symptoms (periostitis and ostitis of the tibia). This boy had a large number of treatments with arsphenamin and mercurial injections, and remained just the same, 4 plus Wassermann. But, with 9 treatments of mercupressen (spirocide), the Wassermann was down to one plus, and all the symptoms of swelling, pain and tenderness, etc., of the tibia, abated or disappeared.

I realize that, in some of these cases, the diagnosis may have been doubtful, as we know that the positive Wassermann alone is not a certain test; yet, where a plus Wassermann shows, I give the treatment as a matter of precaution. In writing this short article, I wish to call the attention of the medical profession to this method of giving mercury in children. It is easy, safe, convenient, and seemingly efficacious. I have as yet not tried it in infants, but I think the same results can be obtained in younger children, that I have obtained in those over five.

The fumigation treatment is an old one, which has been practically abandoned because of poor results, but the combination in this new preparation had given me such good results in adults that it led to a trial with children, as here stated, and the results have been far more satisfactory than any other method heretofore employed.

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## CLINICAL DEPARTMENT

### CASES CONTRIBUTED BY

GODFREY R. PISEK, M.D., New York, N. Y.

ALBERT H. BRADEN, Sherman, Texas.

CASE. No. 9.\* It is only within comparatively recent years that instances of spasm of the cardia, among adults, have been reported in any number, while the occurrence of this condition in early life is sufficiently unusual as to make it justifiable to bring this case to your attention. The pediatrician may well consider these cases worthy of study, for the reason that symptoms in adults may be traced to defects, or to an origin in early life.

Mery, Beck, Morgan and Adams, and La Fétra and Graham of this Society, have reported cases of cardiospasm, most of these on analysis proving to be conditions having an anatomical basis.

Neurotic or primary cardiospasm is attributed by some authorities to a contraction of the left crux of the diaphragm, by others to defective innervation or to localized atony of the esophagus. That the condition does not respond to treatment as readily as one would be led to suppose, by the literature, the following case-history will testify:

E. P., female, of 12 years, who first came under observation in September, 1919, 9 months ago.

*Family History.* Good, father a physician. Other children well and strong.

*Past History.* Normal delivery, at term, with a birth weight of 10 pounds. Regarded as a perfectly healthy infant, and child. At the age of 3 or 4 years, she "developed a strong will," and is said to have been "temperamental." This "wilfulness" grew stronger, so that at the age of 10, she would become "highly excitable," if crossed. She was, otherwise, an outdoor, athletic child, but with a "peculiar appetite" in that she disliked vegetables, eggs and sweets.

*Present Condition.* About one month ago, she suddenly said, "The food chokes me," and left the table to vomit. Since that

\*A case of cardiospasm.

Read before the 32nd Annual Meeting of the American Pediatric Society, held at Highland Park, Ill., May 31, June 1, and 2, 1920.

EDITOR'S NOTE.—This was the last paper submitted by Dr. Pisek prior to his untimely death.

time, at every meal, her food seems to choke her, and feels as though it would not go down. This occurrence is independent of whether the food is relished or not. At night, also, a similar difficulty comes on, which she describes as "sort of strangles me."

Further questioning elicited the fact that for the past year, food, either liquid or solid, would occasionally "stick in her throat," but by "thumping her chest" she would be able to swallow it.

A cough now developed in connection with the night spasms, unconscious so far as concerned the patient, but very noticeable to the family. Her father never found any physical signs to account for this symptom, and even codein gave no relief.

*Physical Examination.* Overgrown girl, with long, narrow thorax, and with good bony development. Musculature better in upper than in lower extremities. Mentality: Normal. Special Senses: Normal. Thorax: Some retraction of supra- and infra-clavicular spaces. Thyroid: Not enlarged. Heart: Negative. Pulse: Regular, good quality. Blood pressure: 85 and 58. Lungs: Negative. D'Espine's Sign: Negative. Abdomen: Negative. Nervous System: Reflexes normal. Co-ordination fairly good. Slight tremor of upper eye lids. Slow response to relaxation test. Posture: Tendency to relaxation of spine and bowing of shoulders. No curvature. Scapulae prominent. Weight: 100½ pounds. Height: 66¼ inches. (Weight in proportion to her height should be about 119 pounds.)

*Further Examinations.* Urinary findings: Evidence of orthostatic albuminuria. Fluoroscopic and x-ray: Confirmed the diagnosis of cardiospasm, made on history and negative physical findings. X-ray examination by Dr. L. T. LeWald.

*Esophagoscopy.* Examination under general anesthesia failed to demonstrate an anatomical basis. Moderate dilatation accomplished at the same time. Esophagoscopy and dilatation by Dr. N. W. Green.

*Further Observation.* After the initial dilatation, bougies were passed at about fortnightly intervals, until her departure for Florida in March of this year. This change was decided upon, because she did not prosper physically, in spite of atropin treatment, dilatation, segregation and a carefully supervised dietary. Her symptoms had materially improved, but there had been

a loss of 7 pounds of weight—to 93 pounds. The hemoglobin at this time registered 75 per cent.

In the South she did well at first, even attending a private school and appearing to enjoy life. Then she contracted malaria, for which she received appropriate quinine administrations. She quite rapidly lost weight, going down to 80 pounds—more than 20 pounds below her former standard. Her original symptoms referable to the cardiospasm returned.

On returning North, a further attempt to exclude a tuberculous focus was made by repeated physical examinations, the x-ray, the von Pirquet and examination of the sputum. All these tests were negative. Examination of the gastric activity showed the secretion and the motility to be well within the normal limits.

A second fluoroscopic examination and x-ray showed a “considerable dilatation of the esophagus with a smooth fusiform constriction at the cardia.” X-ray examination by Dr. W. H. Meyer.

The patient is under observation at the Post Graduate Hospital, New York City; bougies are being passed about every fourth day. The diet consists of bland food, measured to contain 3,000 to 3,500 calories per day, while her only medication is atropin in small doses. There has been a gain of 15 pounds in weight—to 95 pounds—in the past 29 days.

Whether it will be considered necessary to pass a duodenal tube, thereby giving the stomach a complete rest for a term, is still a question, but as the patient is doing so well at present, it is considered best to let well enough alone.

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GODFREY R. PISEK.



CASE No. 10.\* Mrs. E., about 27 years of age, admitted to St. Vincent's Sanitarium for her second confinement. The patient was an unusually large woman, weighing about 230 pounds. Her lower limbs were badly swollen around the ankles and there was marked puffiness under the eyes. The urine showed a very heavy precipitate of albumin. The patient was in labor 36 hours when the baby was born, vertex presentation L. O. A. In spite of the marked albuminuria, there were no convulsions and the patient made an uneventful recovery.

The child was unusually large and lacked one ounce of weighing 13 pounds. This was the more unusual since it was a girl. On the third day, our attention was called to a purple spot about the size of a half-dollar immediately above the angle of the right lower jaw. There was some doubt as to the nature of this contused-looking area but when in the course of a few hours other spots made their appearance over different parts of the body together with bleeding of the gums, we did not hesitate to make a diagnosis of purpura hemorrhagica. Considerable apprehension was felt concerning the baby's life, in view of the fact that not infrequently the disease is fatal. However, this apprehension was allayed when, after 24 hours, no new spots made their appearance and the child left the hospital on the twelfth day entirely clear. On account of the mildness of the condition, the child received no other treatment than small doses of calcium lactate.

From an etiological standpoint, this case is interesting. Purpura is, in the vast majority, if not all cases, the result of the action of a poison on the blood and blood vessel walls and it is common in various infectious diseases. In this case there were no signs of an infection of any nature and we considered very seriously whether or not it might not have been caused by the severely toxic condition of the mother.

A. H. BRADEN.

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\*Case of purpura hemorrhagica.

## SOCIETY REPORTS

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### THE PHILADELPHIA PEDIATRIC SOCIETY.

*Stated Meeting, Held November 9, 1920.*

J. CLAXTON GITTINGS, M.D., PRESIDENT, *in the Chair.*

#### SOME INTERESTING PEDIATRIC CASES WITH A NEW METHOD OF BACTERIOLOGICAL STUDY AND TREATMENT.

DR. MYER SOLIS-COHEN read this paper which was a report of bacteriological studies of 4 cases, based on a test for immunity and susceptibility described by the writer in conjunction with Dr. Geo. D. Heist and Solomon Solis-Cohen. From their studies they concluded that the blood of human beings possesses bactericidal power against large numbers of organisms; that the blood of an individual differs in its bactericidal power against different organisms; that bactericidal power against a particular organism varies in different individuals; that in the discharge of an infected area organisms can be usually found against which the blood of the infected person has little or no bactericidal power; that frequently in such discharge or on such area other organisms are found against which the patient's blood has good bactericidal power; that organisms which are supposed to grow well in human blood fail to grow at all in the blood of some individuals; and that organisms, which are supposed to grow poorly or not at all in human blood, may grow with the greatest vigor in the blood of some individuals.

The practical object of his studies was to make vaccine therapy more specific. It was believed that the failure of autogenous vaccine treatment might be due sometimes to failure to include the etiological organisms in the autogenous vaccine and that certain harmful effects might be due to the injection of unnecessary foreign protein in the form of organisms that have no part in the infection. He regards the object of vaccine treatment to increase the bactericidal power of the blood against the infecting organism.

In the 4 cases which Dr. Solis-Cohen reported, an earnest attempt was made in each to discover the infecting organism; 3 received vaccines containing only those organisms present

against which the patient's blood lacked bactericidal power; to the fourth, serum was given.

Case I. Baby girl, 14 months old. Intermittent attacks of fever as high as  $104^{\circ}$  to  $105^{\circ}$ , with whining cry and discomfort. Physical examination was negative, except for a furunculosis chiefly over the buttocks. A culture on blood-agar was made from the child's urine, which showed pus, and from a papule on the buttocks. *Staphylococcus albus* and *staphylococcus citreus* were isolated from both. A broth culture of each organism was diluted 1:10, 1:100, 1:1000 and 1:10,000 and each dilution was allowed to run in and out of a separate capillary tube, which was then filled with the baby's blood and sealed. After 24 hours' incubation, the tubes were broken and a drop of each stained and examined under the microscope to see if any organisms were present. *Staphylococcus citreus* had grown well in most of the tubes, but *staphylococcus albus* had practically disappeared. A vaccine was prepared from *staphylococcus citreus*. Thirteen doses of vaccine were administered at 5 day intervals, the dose being 100,000,000; 200,000,000; 400,000,000; 800,000,000, and thereafter a thousand million. The baby improved in health and appearance after the first dose. The crying spells with fever, etc., gradually diminished. The furunculosis cleared up. In the past year, the baby has been free from all symptoms and the urine remained clear.

Case II. Girl, age 6 years. C.C. Attacks of fever with urgency to urinate. Urine showed pus cells in large numbers and the hemoglobin was 60 per cent. Diagnosis: pyelocystitis. Blood-agar culture of a catheterized specimen of urine contained *bacillus coli* and *bacillus lactis aerogenes*, both of which grew in the child's blood, the former more vigorously. This is the more remarkable, as colon bacilli do not as a rule grow in human blood. A vaccine was made of both organisms. 8 injections were given at weekly intervals. First dose was 25,000,000; next three doses were 50,000,000; then 2 doses of 60,000,000; and finally 2 doses of 75,000,000. Hexamethylenamin and liquor potassii citratis were also administered. There was distinct general improvement with a gain of  $5\frac{3}{4}$  pounds in 7 weeks. 3 months later the urine showed only a few leucocytes and the child had been free from pain or urgency when the bladder was full and has not wet herself.

Case III. Girl, 4 years old, suffering from orthopnea. Heart

enlarged to right and one inch outside left nipple line. Double thrill over precordia, pulse regular, weak and of low tension. Heart sounds were obscure at first, later a double murmur, crescendo in character, was heard definitely over the entire chest, transmitted toward the axilla and scapula. The temperature curve was septic in type, reaching  $100^{\circ}$ , in the afternoon and was unaffected by sodium salicylate,  $7\frac{1}{2}$  gr. every 3 hours, or by quinine and urea hydrochloride in 3 gr. doses, 3 times a day. Cultures on blood-agar plates from the rhinopharynx contributed 3 isolated cultures, gram negative diplococcus, a diphtheroid and *M. catarrhalis*. When incubated in the child's blood, the first grew up well, the last irregularly and the other only in undiluted culture. A vaccine was made of the gram negative diplococcus. 2 doses of 25,000,000 were administered 6 days apart; a week later, 50,000,000 were given and 10 days later a hundred million. There was never a reaction and the temperature remained practically normal after the second dose. In this case the vaccine treatment should have been continued longer but Dr. Solis-Cohen went off service in the hospital where this little girl was, and his successor discontinued the vaccines, which resulted in a subsequent rise in temperature.

Case IV. Girl, 10 years old. Admitted to hospital for recurrent nose-bleed. Examination showed a markedly hypertrophied heart with a loud mitral systolic murmur, blowing in character and with probably a presystolic element attached; both lungs were infiltrated with enlarged peribronchial glands. X-ray verified these findings. Child had had pneumonia with empyema 7 years previously. Dr. Solis-Cohen was of the opinion that the same organism that participated in the pneumonia was responsible for the empyema and was probably responsible for the cardiac complications as well. Cultures from the sputum showed only the commonly found organisms while the blood culture was sterile. Smears from the rhinopharynx cultured and grown in the patient's blood showed a pure culture of streptococcus hemolyticus. He deemed it unwise to administer a vaccine of this organism and instead injected antistreptococcic serum. One dose of 10 c.c., 2 doses of 20 c.c., and 4 doses of 40 c.c. were given at intervals of from 1 to 4 days. After the third dose, the temperature dropped, reaching normal in 2 days. It rose again and did not begin to fall again until two days after the last dose. She gained  $2\frac{3}{4}$  pounds in 12 days. After a

little over 3 months she was discharged from the hospital, at which time she was walking about all day.

THE USE OF LACTIC ACID MILK IN THE FEEDING OF UNDER-  
NOURISHED INFANTS.

DR. ELEANOR C. JONES, who read this paper, stated that the only remedy for such infants is food which must be prepared in such form that it can be digested and absorbed by an already weakened and atrophied intestinal tract. As the caloric needs of such infants are greatly in excess of that of normal babies, the food must be easily assimilable, highly nourishing and concentrated. To meet these indications, she followed Dr. Marriott's method of using whole, lactic acid milk with the addition of corn syrup in high percentages, as he has pointed out that it has been a matter of common experience that infants, suffering from gastrointestinal disturbances, are able to take larger amounts of milk, artificially soured by lactic acid organisms, than they can of sweet milk. The observation is especially true as regards the digestibility of the fat in lactic acid milk.

Dr. Marriott advises beginning the feedings with equal parts of whole lactic acid milk and buttermilk, then gradually reducing the buttermilk until the infant is taking all pure lactic acid milk. When it is sure that the infant can digest this undiluted lactic acid milk, carbohydrates are added in the form of corn syrup (Karo) which consists of 33 per cent. dextrins, 20 per cent. maltose, 15 per cent. glucose or dextrose and  $3\frac{1}{2}$  per cent. cane sugar. The advantage of using this mixed carbohydrate food is that it is split up in the digestive tract at varying intervals and does not flood the intestines with simple sugars. Furthermore, dextrins are protective colloids and probably have a favorable action in the digestibility of the proteins in the same way as does starch.

Dr. Jones used this method on 4 very much undernourished babies and obtained most excellent results. She calculated that Karo, by volume, contained 110 per cent. of carbohydrates with a caloric value of 110 calories per ounce. In her first series of 4 babies whom she fed on lactic acid milk, she began with equal parts whole lactic acid milk and buttermilk and gradually reduced the buttermilk, but also added about 3 per cent. corn syrup. It made the food more palatable. 3 of the 4 babies were gradually

increased till they were taking nearly pure lactic acid milk and 10 to 12 per cent, corn syrup. No vomiting nor diarrhea occurred in any of these cases, while frequent examination of the stools showed no fatty acids and very little soaps. On this feeding the characteristic stools were smooth and salve-like, light gray in color, numbering 1 to 3 per day. The fourth infant was unable to take more than  $2\frac{1}{4}$  per cent. fat; the stools invariably showed undigested fat, if this amount were exceeded. These infants were fed every 4 hours, 6 feedings per day. None of them developed any symptoms of intoxication, despite the high content of the food and again showed the high tolerance of atrophic infants for carbohydrates. The daily caloric value of food reached 80 to 100 calories per pound of body weight. The weight gain was very satisfactory, every infant, after a few days of adjustment, gained steadily.

Dr. Jones reported another series of atrophic infants fed on lactic acid milk with equally good results. These babies from being horrible, shrivelled and distressed looking specimens, grew to be healthy looking babies, their flesh became firm and elastic and their spirits brightened with their general appearance of well-being.

She concluded from her study of these cases that whole lactic acid milk, with corn syrup added, is especially indicated in young atrophic infants, if neither vomiting nor any organic disease are present, as it supplies a concentrated food of high caloric value in a form that can be assimilated by the weakened digestive organs of the undernourished infant.

#### THE FREQUENCY OF PYELITIS IN ITS RELATIONSHIP TO THE NOS- OLOGY OF SO-CALLED OBSCURE TEMPERATURES IN INFANTS.

DR. HARRY LOWENBURG pointed out in this paper the great difficulty in determining the cause of fever in infants and young children. In such little patients the physician's ability to determine the cause of temperature of more or less indefinite duration, particularly when it is of so-called obscure origin, depends upon the ability and desire to conduct a thorough and painstaking physical examination and by the limitations of laboratory investigations and the use made of these. After enumerating the common causes of so-called obscure fever in infants and young children, he emphasized the importance of pyelitis, a disease common enough in

infancy, but frequently overlooked by the general practitioner, on account of omitting the important procedure of examining the baby's urine.

*Symptoms.* Constitutional or other symptoms, aside from irregular fever of more or less indefinite duration, may be absent. An examination of the urine reveals pus and the riddle is solved. The number of leucocytes or pus corpuscles to the field necessary to a diagnosis may cause some confusion. In the absence of vaginitis, 8, 10, or more corpuscles should at least create a strong suspicion. Still places the number as low as 6 or less to the field. This alone, to his mind, without fever or albumin, would hardly, in a female infant, be convincing evidence. Neither a few corpuscles alone, nor albumin alone occurring in traces, would make certain the diagnosis, but both together presenting in an acid urine, obtained by catheter or after vulvar cleansing, especially if the colon bacillus is present, offer convincing evidence, in the presence of fever, not due to other demonstrable cause of the incidence of this disease. Pyelitis occurs without fever. Here, the history of a previous acute illness, not far removed from the present, and probably not diagnosed, is usually available and highly suggestive especially with pus in the urine at the present time. Relapses are quite common under these circumstances. Frequently in infectious diseases pus appears in the urine with albumin from toxic irritation of the kidneys, but if no other disease be demonstrable the urinary findings are sufficient to make the diagnosis of pyelitis.

Constitutional symptoms may be intense at times: convulsions, rigors, etc., abrupt high fever, cyanosis, vomiting, diarrhea, the diagnosis being made by exclusion and on the findings in the urine.

*Urinary symptoms.* Aside from the classical ones already given, there may be tenderness along the ureters; painful and frequent micturition are rarely present unless cystitis accompanies the pyelitis. Cystoscopy and ureteral catheterization offer a valuable means of studying and treating chronic pyelitis which does not yield to potassium citrate, hexamethylenamin or vaccines. Dr. Lowenburg said that most of his patients were female and that in all of them the colon bacillus was found in the urine. He described thoroughly the technique of obtaining specimens of urine for routine study and for bacteriological study.

*Treatment.* Potassium citrate or other alkalizing agent must

be administered till urine becomes pus and colon bacillus-free. The effect of the citrate is practically specific. Large doses may be necessary. The urine must be kept alkaline at all times till it is pus and bacilli-free when the dosage of citrate may be gradually decreased and finally stopped. It may be necessary to give as much as 20 grains every 2 hours, day and night for weeks. This has been done without any apparent ill effects on the child. He stated that hexamethylenamin had given him no encouraging results except where it apparently produced temporary cleansing of the urine in a case of chronic pyelitis, without fever. Hexamethylenamin must not be administered during the use of alkalies. There are cases which will not yield permanently to this drug nor to the alkalies; there is always a relapse when the drugs are discontinued. In these cases the organisms probably remain dormant during the alkalization of the urine, later resist the alkaline environment and become clinically active. They are, as it were, alkaline fast. Auto-genous vaccines should be tried in these cases in large doses and over long periods of time. In a boy I have witnessed what appeared to be a striking effect from the use of vaccines.

Dr. Lowenburg reported many cases of pyelitis illustrating the finding of the cause of the so-called obscure fever with their treatment and the lessons learned from their study.

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## THE PHILADELPHIA PEDIATRIC SOCIETY.

*Stated Meeting, Held December 14, 1920.*

J. CLAXTON GITTINGS, M.D., PRESIDENT, *in the Chair.*

### THE TREATMENT OF NEPHRITIS IN CHILDREN.

DR. LEWIS WEBB HILL, of Boston, read this paper in which he reviewed our present knowledge of nephritis in childhood and its treatment in a practical manner that practitioners could use in their private practice.

*Discussion.*—DR. ALFRED STENGEL opened the discussion by expressing his appreciation of the paper which Dr. Hill had just read as it represented a real pediatric study. As a matter of fact, the clinical manifestations of certain diseases are quite different in young children from that seen in adults. This is particularly true



of cardiac diseases but it is in a measure the case with renal affections. We have not in childhood the modifying influence of independent or secondary arterial disease to complicate the picture. For this reason a classification appropriate and useful in later life has little place in the discussion of nephritis in childhood. The speaker has shown in his whole presentation, and in especial in his classification of nephritis in childhood, this knowledge and appreciation.

He was particularly interested in the prognosis and subsequent history of acute nephritis in children and his own experience coincided with that of Dr. Hill's, that of the many cases which do not die, a large percentage recover entirely or, at least, seem to do so; but from a small number of observations he was compelled to suspect that the apparent recovery may not always be a complete cure. He said he could cite a number of instances of severe nephritis occurring in adults, in adults who had had scarlatinal nephritis in childhood and had apparently recovered. In a few of these, the evidence of connection between the later chronic glomerular nephritis and the former acute scarlatinal nephritis has been especially strong because the chronic condition was recognized (and was attended by excessive pressure—200 m.m. or more and advanced arterial disease) at an age—the late teens and the early twenties—when such nephritis is unusual. In a very few cases, he had seen the patient at both stages—that is, in the original acute attack and in the chronic stage. One of these was a medical man who had a severe hemorrhagic nephritis in youth and was kept in bed for several months and then sent to Florida for an equal period with the result that he recovered fully. For a number of years repeated urinary and physical examinations disclosed no evidence of his former trouble. He later, in the mid-forties, developed excessive blood pressure and other evidences of chronic nephritis, without any discoverable intervening cause for his renal disease. It is possible that a certain vulnerability without active or discoverable disease, is left behind and that under the operation of subsequent influences, such as might not injuriously affect the average person, secondary renal disease occurs. This is practically the same as the persistence of some latent renal disease, as I take it, vulnerability of this kind implies some organic damage even if it is not obvious. The important matter to his mind was that we should recognize that patients, who have apparently recovered fully from

acute infectious nephritis, may still have a kidney damage that renders them liable to subsequent revival of active disease.

With regard to treatment, Dr. Stengel said that he had been glad to hear Dr. Hill say that he paid much attention to the protein requirements of the patient, as the usual tendency is to attempt the withdrawal of practically all protein. It is more judicious that we should know the requirements with some definiteness and only restrict the ingestion to this point so that excessive nitrogenous excretion, through the kidneys, may be eliminated. The speaker mentions 1.5 gms. per kilogram of body weight. Judged by experience in adults, this would seem a rather too liberal amount, but the greater nitrogen requirements of the growing child must be recalled and the adoption of this figure is another evidence that the speaker's observations are properly based upon experience in children and the consideration of the physiology of childhood.

He thought that the matter of salt intake should not be based so exclusively upon the evidence of delay or deficiency in salt excretion. There is reason to believe that the excretion of salt or nitrogenous end products in large amounts may become a source of irritation even though the capacity of the kidney has not as yet shown evidences of impairment. A reasonable restriction of both salt and nitrogen is therefore advisable, even if no defect in their excretion is discovered.

Dr. Stengel's experience with the Edelbohl operation in a few cases of nephritis in children had been very satisfactory and, in 2 of them, very dramatically so. These cases were instances of protracted nephritis with marked edema, reduced excretion of urine and marked albuminuria. Rapid improvement in all particulars followed the operation. In apparently like cases in adults, his experience had been as unsatisfactory as it had been gratifying in childhood.

DR. HAROLD AUSTIN, of the Rockefeller Institute, said that Dr. Hill had made an excellent selection of functional tests which are simplest to perform and of most value for clinical classification, prognosis and therapy. He could not agree with Dr. Hill that it was established that a considerable group of cases of nephritis were due to tonsillitis. That nephritis frequently occurs associated with tonsillitis as with other infections is quite clear, but the precise relation between tonsillitis and the etiology of nephritis

still remains, he thought, to be established. As to the use of urea as a functional test, it seemed to him that the study of the concentration of urea in the urine, following the administration of a large dose of urea, or the study of the relation of the blood urea to the rate of the urea excretion by use of a suitable quotient of urea excretion, is of greater value than the mere estimation of the blood urea alone. He agreed with Dr. Hill and Dr. Stengel that extreme limitation of protein in the diet for more than a very brief period of time is not of demonstrated value and is quite possibly harmful. Concerning the relation of renal function, salt retention and edema, the data are extremely difficult to interpret. The differentiation between renal and extrarenal causes of salt retention is, as yet, inadequate, and salt retention, even when occurring in nephritis, cannot certainly be ascribed to impairment in the capacity of the kidney to excrete salt. The interpretation of the results of the Mosenthal test meal is obscured by the impossibility of excluding extrarenal causes in some instances for the types of reaction known to occur in association with nephritis. Eppinger has shown that the administration of thyroid to individuals with parenchymatous nephritis with edema may lead to rapid subsidence of the edema and that, experimentally, thyroid feeding favors the absorption of saline injected subcutaneously. Its use in nephritis, however, demands caution since he observed in some cases an increase in albuminuria and hematuria following the administration of thyroid. He urged the importance of calibrating the syringe used in the injection of phthalein and called attention to occasional variation in the concentration of the dye in the ampules. He pointed out that functional tests had an importance in the study of kidney disease in addition to their value merely for purpose of clinical classification, prognosis and therapy. Any functional test applied repeatedly in the same patient must add to our knowledge of the pathological physiology of nephritis and it is from this point of view that their use is especially to be urged.

DR. HARRY LOWENBURG agreed with much that Dr. Hill said about the etiology of nephritis. He called attention to the relationship between simple acute non-suppurating adenitis and hemorrhagic nephritis. In nearly half of his cases of this kind, this condition had preceded the nephritis and without follicular tonsillar involvement. He asked Dr. Hill what his experience had

been in this respect with reference to the cases he reported. As regards treatment, he said that he had had very good results from treatment based upon Dr. Martin Fischer's work, and asked Dr. Hill what he thought of Fischer's theory. His work and results on the soluable effect of acids upon gelatinous colloids and the restraining effect of neutral salts, as sodium chloride, seemed to him, to be more than chimerical and to be clinically valuable. In acute nephritis there is a local kidney acidosis which is a factor to consider, and he thought the administration of salts, as mentioned by Dr. Hill, was a very good procedure. However, he was unconvinced that salt, in the diet of the nephritic, is harmful. He believed in alkalization and favored large doses of potassium citrate. Sometimes all treatment fails. A striking result was witnessed following the injection of an autogenous vaccine made from the patient's urine from which streptococci were recovered. Dr. Stengel may recall this case. It may have been merely coincident, but nothing up to this time seemed to influence the hematuria. Hematuria disappeared within 24 hours from the time of the first injection of vaccine. Perhaps Dr. Hill would tell his opinion of the use of vaccines. If only a few of the acute nephritis cases die, Dr. Lowenburg could not see any use of exposing the patient to an operation as serious as the Edelbohl's. However, he believed the Edelbohl operation to be of some value in selected cases of the chronic forms of nephritis.

DR. H. I. GOLDSTEIN said that like Dr. Lowenburg he, too, had seen very striking results by treatment with autogenous vaccines. He did not agree with Dr. Hill, if he understood him correctly, that the most valuable and the most delicate test for estimating the amount of damage in the kidney was the Mosenthal test. He believed that the estimation of uric acid excretion in the urine and its retention in the blood is the most delicate test in estimating kidney function and exposes the child to no risk whatsoever, as the urea test may not be devoid of some risk and danger in children suffering from renal deficiency with urea nitrogen retention. Dr. Hill mentioned impetigo contagiosa as an etiological factor in nephritis. He wished to know how nephritis could be attributed to such an apparently mild skin condition.

DR. J. CLAXTON GITTINGS thought the Mosenthal test to be as valuable as any other single functional test. He exhibited a graphic chart as an useful indication of the progress of the disease. On it

are charted the amount of fluid intake, urinary output, and the weight at 24 hour intervals. At a glance can be seen whether the kidneys are eliminating fluid in proportion to the intake, and the relation of the output to the weight. When the output line habitually falls below that of the intake, the progress of the case cannot be considered satisfactory. The most practical method of reaching a decision as to the etiological relationship of tonsillar infection to various diseases would be in the collection of accurate statistics as to the health of the children before and after tonsillectomy. Dr. Gittings cited a case of apparently hopeless cardio-renal dropsy which he had seen in the Army. Dr. Frederick M. Allen took charge of the case and fluid intake absolutely cut off, nothing given but pure carbohydrates such as lactose and dextrose. After 6 days, thirst became pronounced, then small amounts of water, other carbohydrates and fat, and finally small amounts of protein. In those first 6 days when all fluid was withheld, the disappearance of the dropsy was as rapid as any he had ever observed. In 3 or 4 weeks the man was able to go about for automobile rides. Recently, in the Children's Hospital, he had an edematous nephritic child, who after almost 48 hours of refusal to take fluid or food, edema began to disappear and in 4 or 5 days had practically fully disappeared. Such cases emphasize the importance of starvation and water deprivation upon the relief of edema; such powerful measures, however, are not devoid of danger and must be prescribed only in selected cases and under careful supervision.

DR. LEWIS WEBB HILL, in closing, said that he had never used Fischer's methods and consequently did not speak of them. The only possible justification of vaccine therapy in nephritis would be the presence of some organism in pure culture in the urine. This probably does not often happen. The Edelbohl's operation certainly should be reserved for only the worst cases, using it only on patients in a critical condition, as a last resort. In his paper he tried to consider the treatment of nephritis as it applies to general practitioners in the home. The Ambard coefficient is a complicated test; complicated as regards collecting the blood and the urine; complicated in calculating afterwards. In his opinion it has no value whatsoever in a practical way for practitioners of medicine to use in the home, and he was very much in doubt if it is of real value under any circumstances. He was sorry if he gave the

impression that the 2 hour test is the most valuable of all. In hospital practice, where we have access to the help of an expert laboratory worker, other tests may be done which may have greater significance, but in private practice in the home these tests are somewhat difficult, and therefore, the 2 hour test stands out as one of the most practical of the kidney function tests. He stood by his statement that it was the most delicate of any of the tests, so delicate that it must be interpreted with a good deal of caution.

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CHEMICAL EXAMINATION OF THE CEREBROSPINAL FLUID IN THE DIAGNOSIS OF TUBERCULOUS MENINGITIS (Lyon Médical, December 10, 1920). G. Mouriquand and Morenas lay stress on the utility of a chemical examination of the cerebrospinal fluid in cases in which the cell content of this fluid or the general clinical picture may prove misleading. Thus, in a child convalescing from whooping cough and seized suddenly with convulsions and other evidences of meningitis, lumbar puncture yielded a clear fluid with cellular reaction, reduction of albumin, and a marked excess of sugar. Two days later, the fluid showed improvement and on the fourth day the fever and meningeal signs passed off. On the other hand, in a similar case of meningeal syndrome appearing during recovery from whooping cough the cerebrospinal fluid showed, aside from lymphocytosis, an excess of albumin and absence of sugar. The child died, and postmortem examination showed tuberculous meningitis. In another case, a child of 8 years had fever, headache, vomiting, and constipation one week before admission to hospital. Examination revealed a positive Kernig's sign, but the reflexes were normal, and there were merely slight photophobia and headache. On lumbar puncture the fluid issued without pressure and after prolonged centrifugation yielded only one lymphocyte in ten microscopic fields. Chemical examination, however, revealed an excess of albumin and only traces of sugar. Similar results were obtained three and eight days later, and meanwhile distinct clinical evidences of meningitis appeared. At the fourth examination there was marked lymphocytosis; the child died the next day, and the autopsy showed tuberculous meningitis.—*New York Medical Journal*.

# ARCHIVES OF PEDIATRICS

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## ORIGINAL COMMUNICATIONS

THE DIAGNOSIS OF SOME OF THE MORE COMMON  
MOTOR DISTURBANCES MET WITH IN CHILDREN.\*

By J. L. JOUGHIN, M.D.

New York.

It was no easy task for me to decide as to the subject on which I should address you this evening. The great majority of our organic diseases of the nervous system do not occur in children and this fact has materially restricted my choice of subjects. I have further narrowed this already narrow field by excluding from consideration:—1. Conditions with which I am sure you must be at least as familiar as I am, for example, tubercular meningitis, cerebrospinal meningitis, etc.; 2. Conditions such as

\*Read at the regular monthly meeting of the Brooklyn Pediatric Society, February 24, 1921.

dystonia, congenital myatonia, etc., which, although very interesting, are exceedingly rare; 3. Conditions such as mental deficiency and gross defects of the nervous system where our therapeutic will unfortunately avails us so little.

I thought therefore, after due consideration, that a short discussion of the diagnostic significance of some of the motor anomalies met with in infancy and childhood might be of interest to you. The subject is immense and many disturbances of the neuromuscular system I have altogether omitted from consideration, but this hiatus is unavoidable in a short paper of this character. If, as a neurologist, I can give you a few facts of clinical value and may perhaps in return add something to my own store of knowledge I will feel that we may separate this evening having mutually benefited.

I will try to discuss in as simple a way as possible and without inflicting upon you our neurological nomenclature:—1. Tremors; 2. Athetosis; 3. Chorea and tics; 4. Convulsions; all as they occur in infancy and childhood.

**TREMORS.**—A tremor has been defined as an involuntary, rhythmical oscillation of the whole or a part of the body. These 3 attributes, rhythm, lack of volitional control, and, for any given tremor, a definite amplitude of oscillation, are the only characteristics constantly met with in all tremors. Tremors vary widely in rhythm; on the one hand, a rapid oscillation occurring 10 to 12 times a second (hyperthyroidism); on the other, a slow movement occurring not oftener than 3 to 5 times a second (paralysis agitans). They vary even more in intensity, that is, in amplitude of oscillation, than they do in rhythm. The slight, hardly perceptible tremor of chronic alcoholism can be contrasted with the wide excursions of the affected members seen in multiple sclerosis.

One may safely state that there is no tremor pathognomonic of any one nervous condition. Any of the diseases immediately to be enumerated, while ordinarily associated with a certain type of tremor, may present another variety of these abnormal movements. The diagnosis of the underlying condition is therefore to be sought outside of the tremor, although the type of disturbance encountered may orient us to pursue our inquiry in some specific direction. We test for the existence of tremor in 3 ways:—1. With the member at rest; 2. With the member ex-



tended; 3. With the member performing some voluntary, purposeful action, this latter to bring out the so-called intention tremor which augments in intensity as the action approaches its end. (Bringing a full glass of water to the lips demonstrates it perfectly).

Tremors may be classified under 5 heads as follows:

1. *Physiological Tremors*. Tremors induced by exposure to cold, often perceived in an undressed patient; by over-fatigue, as often seen in athletes after great muscular exertion; by emotional stress, as seen frequently by all of us in our offices in patients undergoing examination. These tremors are encountered both in children and in adults. Incidentally, it may be remarked that fatigue and emotion exaggerate all tremors; rest and tranquility lessen them.

2. *Hereditary Neuropathic Tremors* (Essential and Familial Tremors). This occurs in patients of whom the direct or collateral ascendants are neuropathic, are sometimes tremblers themselves, but who, at any rate, have transmitted to the child a defective neuropiasm.

The diagnosis is based on: 1. The defective heredity; 2. The absence of symptoms which might include it in another group. It is the *sole* symptom; 3. A progressive course and its marked resistance to all forms of therapy.

The tremor develops sometimes in infancy, often before or during the period of pubertal development, occasionally late in life. In children, it is usually rapid (rhythm, 6 to 9 per second), begins and is most marked in the arms, ceases during sleep and sometimes during repose.

A typical case is as follows: A fine tremor of the right hand was noticed in a little girl of five. It shortly involved the left hand and within 3 months also the head. It was not intentional. It gradually increased in intensity during the first 6 months of its existence but for the last 12 months has remained unchanged. There were no other neurological symptoms. The child was intelligent and not over-excitable. She vouchsafed the information that "Grannie (maternal grandmother) shook too." On investigation, this proved to be correct and in addition 2 maternal aunts, whom the child had never seen, were also "tremblers." After 2 weeks observation in the ward, the patient was discharged unimproved.

3. *Tremors Occurring in the Neuroses.* (a) *Hysterical tremor.* This deserves a rather more lengthy discussion owing to its frequency, its polymorphism, and its favorable response to therapy. Here the tremor is not the only symptom and indeed in many cases is not even the most striking symptom. Other signs of hysteria are almost invariably present or have been present (paralyses, convulsions, anesthetics, globus hystericus, abnormal emotional reactions, etc.). The onset is often sudden, usually occurring shortly after some severe psychic or physical trauma or is due in some instances to more complex mechanisms. Its cessation is often as abrupt. Its distribution may be monoplegic, hemiplegic, or diplegic. I believe the first to be the most common. Its duration varies from minutes to years. Its rhythm and intensity vary widely, not only in different patients but in the same patient at different times. Strictly speaking, we have no hysterical tremor; we have hysterical tremors, for the tremor of hysteria may simulate all tremors, from the rapid, fine, non-intentional tremor of hyperthyroidism to the slow, coarse, intentional tremor of multiple sclerosis.

The diagnosis is based principally upon: 1. Sudden onset after psychic or physical trauma; 2. Its association with other hysteric symptoms; 3. Its variability of type even in the same individual; 4. Its prompt cure in many cases by the application of proper therapeutic measures.

(b) *Epileptic tremor.* Following a severe convulsion a tremor may persist for some time but this is not an epileptic tremor; it is a physiological tremor and is due to muscular fatigue. The epileptic tremor proper may form a part of the general convulsion, a fact of little interest to us, or it may exist as the sole motor phenomenon, an equivalent for the more complete convulsive attack, a fact of very great interest to us. Such tremulous attacks, occurring at irregular intervals, especially if associated with somnolence or peculiar behavior, merit thorough investigation in order that this diagnosis may be definitely excluded.

4. *Tremors in Organic Diseases of the Nervous System.* These merit in this paper only brief mention, the diagnosis being invariably made from the concomitant signs of organic disease.

(a) The pre- or more usually post-hemiplegic tremor. A pure type is uncommon, a choreiform or athetoid movement often

altering the picture. It is associated with the clinical signs of hemiplegia.

(b) The tremor of brain tumors, found especially in frontal lobe, midbrain, or cerebellar lesions, and associated with the signs and symptoms of cerebral neoplasm. The cerebellar tremor is the one most often met with. It is closely allied in type to that of multiple sclerosis, that is to say, it is slow, the oscillations are of wide range and markedly intentional. Headache, vomiting, choked disc, nystagmus, slow scanning speech and the drunken gait and station of cerebellar disease are one or all evident.

(c) Multiform tremors have been seen in encephalitis lethargica, but owing to their rarity they will not be discussed here.

5. *Tremors in the Intoxications.* These are uncommon in childhood. Alcohol, mercury and lead tremors are practically never encountered. Tremors from excessive indulgence in tea and coffee are however not so rare and recently I saw a little girl of 5 who showed a marked, moderately intense tremor of the hands due to the ingestion of 2 to 4 cups of coffee daily. This entirely disappeared within 72 hours after the coffee had been discontinued. To demonstrate conclusively the etiological factor we re-administered coffee, and within 2 hours the tremor was again perceptible.

**ATHETOSIS.**—Athetosis was first described by Hammond of the Post-Graduate Hospital in 1871. The typical athetoid movement is so characteristic that once seen it is never forgotten and seldom incorrectly diagnosed. The movement is an involuntary, arrhythmic, slow, serpentine twist of the part affected. It has been aptly compared to the movements of the tentacles of an octopus. It is most marked in the arms but is sometimes seen in the feet and face and is always more pronounced distally. Flexion, extension, pronation, supination, circumduction of the parts affected occur in no regular sequence. In the hand, where it is most typically observed and easily studied, extension of the wrist and fingers predominates over flexion and these bizarre movements often affect successively one finger after the other, the hand, as a result, assuming the most remarkable attitudes.

Athetosis most commonly develops following an infantile hemiplegia and it is very rare in the hemiplegias of adult life. If bilateral, it is known as double athetosis, is seen in the congenital

or acquired spastic diplegias (Little's syndrome), and a variety of pathological conditions underlie it. Athetosis evolves slowly and once constituted never regresses, nor can it in any way be influenced by treatment.

**TICS (Habit Spasms) AND CHOREAS.**—These conditions will be considered together owing to their often close superficial resemblance, and the points of differential diagnosis will be later stressed. In both conditions, the movements are involuntary, are jerky and spasmodic, arrhythmic and may affect any or all parts of the body. In spite of the fact that in most cases the diagnosis between tic and chorea can be made with considerable facility, this is not always the case, and there are not rare patients in whom the diagnosis is more than ordinarily difficult. It is by no means uncommon for children suffering from some form of habit spasm to present themselves in our clinics with a diagnosis of chorea which they are faithfully trying to clear up under medical supervision by the ingestion of 5 drops of Fowler's solution t.i.d. The reverse error, the mistaking of a chorea for a tic is undoubtedly rare, but is occasionally seen. It is important that the correct diagnosis be made, as the treatment of the 2 conditions differs radically.

How may we distinguish between these diseases? It is perhaps simpler to contrast the differential points in tabular form, but it must be remembered that there are many exceptions to the dicta laid down below.

#### CHOREA.

*Course.*—From a few weeks to a few months. The patient is then free from movements until a recidive occurs.

*Distribution.*—Generalized often but usually more marked on one side. The tongue is often affected and the lower, rather than the upper, portion of the face.

#### TIC.

From days or weeks to months but as one movement disappears another elsewhere tends to replace it.

Localized usually, face, neck, arm or leg (rarely tongue). The upper portion of the face is affected more than the lower.

- Character & Origin.*—Involuntary, jerky, not in any way purposeful. No primary irritation to account for its genesis. Involuntary, spasmodic and often definitely purposeful. In many cases the effort to avoid some point of irritation is the genesis of the condition (dust in the eye, irritating collar, etc.)
- Psychic Phenomena.*—Marked irritability and emotionalism. No psychic phenomena connected with movements. Strong feeling of desire which finally becomes irresistible until the act is consummated. Relief and satisfaction experienced afterwards.
- Speech.*—Affected as evidenced in ordinary conversation, sometimes lost. In mild attacks, inability to intone evenly (voice-sign), due to laryngeal, tongue and respiratory muscle contractions. Normal usually.
- Paralysis.*—Present. Sometimes absolute (limp chorea), usually only of mild degree. The inability to steadily grasp the hand of the examiner is a very valuable sign. No paralysis. Grasps the hand firmly.
- Tendon Reflexes.*—Sometimes increased, often diminished, unequal or even absent. Normal.
- Associated Signs and Symptoms.*—Febrile course, tonsillitis, arthritis, endocarditis. None

In doubtful cases, before treatment is instituted, these differential indications should be carefully scrutinized seriatim and I believe that if this precaution is exercised it is possible to correctly diagnose practically 100 per cent. of our patients. If we fail to do this, certain atypical choreas and tics will undoubtedly be wrongly interpreted.

CONVULSIONS.—The impossibility of discussing in any serious way the vast subject of convulsions in the short space that I have at my disposal is sufficiently obvious to all of you. Excluding therefore those convulsions associated with the acute infections and the exanthemata, and those symptomatic of toxemias and cerebral lesions, I will only say a word or two regarding the diagnosis of seizures occurring in infancy or childhood where the etiologic factor is uncertain.

1. *Infantile Eclampsia*, that is to say convulsions occurring under the age of 2 years. These may occur immediately or shortly subsequent to birth, and are, in breast fed babies, in the great majority of instances, due to some degree of cerebral injury resulting from dystocia. This injury may be slight, only a few convulsions occur and they disappear never to return, or they may persist and ultimately paralysis, mental enfeeblement, or death may ensue.

Infantile convulsions occurring after 3 months fall into a different category; here we are dealing in all probability with a spasmophilic diathesis. Certainly up to 2 years, possibly until 3, this assertion holds true in most cases—not in all. True epilepsy does develop even as early as this and the statistics of Gowers and Starr, both careful observers and working independently, showed that out of 3590 cases of epilepsy 12 per cent. could be definitely considered as originating during the first 3 years of life. Can we clinically distinguish between the 12 epileptic and the 88 non-epileptic babies? Not by the character of the fit, for, allowing for individual variation, the convulsion of spasmophilia is identical with that of infantile epilepsy. Associated carpo-pedal spasm, laryngospasm or the occurrence of Weiss', Chvostek's or Trousseau's signs (the latter being pathognomonic) determine the diagnosis but these phenomena are present in only the minority of cases, and if absent, we have to rely on our electrical tests to differentiate the 2 conditions. Briefly, we may say that an anodal

opening contraction of the muscle obtained in a child under 5, with 5 milli-amperes or less of current, if associated with convulsive seizures, means almost certainly spasmophilia and with or without such symptoms this becomes practically a certainty if we are able to obtain a contraction of the muscle with the cathodal opening contraction under 5 milli-amperes. These reactions considered in connection with the history and clinical findings enable us to correctly diagnose the vast majority of our patients.\*

2. *Convulsions Occurring from the Age of 3 until the Age of Puberty.*—Here we no longer have to diagnose between spasmophilia and epilepsy but between hysteria and epilepsy, and fortunately this is usually no impossible task. Many of the differential points are familiar to you all and hardly need reiteration. The epigastric aura, the initial cry, the violence, abrupt onset and unexpectedness of the attack, the tonic and clonic phases, the absolute unconsciousness, the bitten tongue and bloody, frothy salivation, sub-conjunctival hemorrhage, the sphincteric incontinence, the occasional rise in temperature, the short duration of the fit and the post-seizural headache and somnolence are all known to you as characteristically met with in a true epileptic convulsion.

On the other hand, in hysteria emotional disturbance often induces the attack, usually no distinct aura and no sudden onset characterize it, the movements and attitudes are bizarre, dramatic; unconsciousness is seldom absolute, the sphincters are intact and the tongue unbitten, and after the seizure—often of long duration—has terminated, the patient does not suffer from the somnolence, headache and exhaustion produced by an epileptic attack. Hysterical convulsions can be produced in many cases by the examiner through suggestion; epileptic, never.

The epileptic in his seizure never speaks; the hysteric is often too voluble. A nocturnal attack may be either epileptic or hysterical; an attack occurring during sleep, not necessarily nocturnal, and of which the patient on awakening knows nothing, is epileptic. Babinski always laid stress on the cyanosis observed only in the epileptic crisis and personally I have never seen a cyanotic hysteric. As Babinski well remarks, this is the only ma-

\*The determination of the spasmophilic reaction is not difficult and should be performed as a routine test on all children under 5, who exhibit convulsive seizures. For a concise description of the very simple technique the reader is referred to Holmes, J. B.; *The Reliability of the Electrical Diagnosis of Tetany*, *Am. Jour. Dis. Child.*, vol. 12 (July, 1916), p. 1.

jor element of the epileptic convulsive syndrome which the hysteric cannot simulate. In addition, in epilepsy, the dull, apathetic face with absence of emotional display, the scarred head and tongue, and, during the attack a pupil dilated and rigid to light with sometimes a temporary Babinski reflex, or clonus, or absence of the cutaneous reflexes are often noted. These phenomena do not occur in hysteria. True mental deterioration (dementia) is a sequela of epileptic attacks, not of hysteric.

We thus see how different in genesis, in symptomatic display, and in their ultimate effect upon the mentality and personality of the patient are the convulsive manifestations of these two diseases and while in some cases it is impossible to definitely diagnose the patient's affliction at first view, a careful consideration of the differential points should enable us to reduce our error to an irreducible minimum.

616 Madison Avenue.

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WHEN THE NEW-BORN INFANT DOES NOT SUCK THE NIPPLE (Nourrisson, Paris, Sept., 1920). P. Balard has noted that when the woman is delivered in a cold room, it is often impossible to get the infant to suck at first. The generalized muscular atony resulting from the chilling may prevent the effort of sucking. The effort required for this is evident in the increased arterial pressure after nursing. The records of 1,500 infants show that the infants of mothers who had been given chloroform were later in sucking spontaneously than the infants of other mothers, sometimes fully twenty-four hours later. In certain rare cases the infant merely laps and chews on the nipple, without sucking. In such cases, artificial feeding is the only resort as the fluid flows more readily from the bottle than from the breast without the sucking traction. In one such case the child seemed mentally normal when re-examined ten months later. Every effort must be made to keep up the secretion of breast milk until the infant is able to take the breast normally. Sometimes a dose of castor oil will clear out the meconium and after this the child will take the breast correctly. In others the anorexia may long persist, compelling gavage, and suggesting the possibility of malformation of the brain.—*Journal A. M. A.*



# A STUDY OF THE FOOT IN INFANCY AND CHILDHOOD, WITH SPECIAL REFERENCE TO PREVENTION AND TREATMENT OF DEFORMITY.\*

By CHARLES OGILVY, B.A., M.D., F.A.C.S.,

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Far too little attention has been paid to the feet in infancy and childhood. Deformities at birth are numerous. Subsequent deformities developing from weightbearing occur in about 50 per cent. of all cases. The correction of congenital deformities, when treatment is begun immediately, is comparatively simple. The care and treatment of developing deformities, when recognized early, means immediate relief and permanent correction. On the other hand, if either a congenital or an acquired deformity is allowed to persist for a year or more without recognition and proper supervision, the result is a persistent disability of greater or less extent, attended by a long, serious and tedious treatment. *For the immediate correction of congenital deformities and for the prevention of acquired deformities, you and I are responsible.*

Our attention is constantly called to the tremendous handicap in efficiency in these cases. If acquired in childhood, the burden of our responsibility is emphasized. For these reasons do I submit for your consideration and discussion this subject, which has been of intense interest to me during the past 15 years.

*Congenital Deformities.*—Of these I shall speak of but 2, namely, congenital equino varus and congenital calcaneus. These are of most frequent occurrence. Speaking generally, other deformities are modifications or combinations of these, and as such, the general principles of treatment are the same. *The treatment of every congenital deformity should be begun at birth.* There is no exception to this rule.

*Congenital Club Feet.*—For the first 3 days, stretch the shortened structures on the inner border of the foot twice a day. Grasp the heel firmly in one hand and the forefoot in the other. The foot is forcibly stretched and bent over against the deformity. For the first 3 days, no bandage is required. After this time, however, the correction obtained must be maintained by a retention

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\*Read before the Brooklyn Pediatric Society, meeting held December 29, 1920.

dressing. An adhesive plaster dressing has many advantages over others, and by an application of the following method the severest grades of deformity may be corrected. Until the end of the third week, apply the adhesive plaster over a one layer gauze bandage to protect the skin. After the end of the third week, apply the adhesive directly to the skin.

Having first manipulated the foot and obtained as much correction as can be obtained by 5 minutes forced stretching, apply 5 strips of adhesive plaster, 1 inch wide, and from 7 to 8 inches long, as follows: Constantly maintaining the correction of the foot with one hand, the other hand is used to apply the adhesive. The first strip starts at the inner side of the ball of the great toe, passes under the foot and is drawn taut up the side of the leg. The second slightly overlaps the first strip but is applied farther back on the foot, passing around the sole and up the outer side of the leg to the knee. The third is likewise applied around the heel passing under it and up the outer side of the leg as were the first two.

Now place a small wad of cotton over the dorsum of the foot directly over the front of the ankle joint. This is a most important factor in the prevention of circulatory disturbances. The fourth strip of adhesive is now applied extending from the outer border of the foot across the sole and up the outer side, diagonally over the ankle joint and continued spirally about the leg. This strip fastens firmly to the ankle and leg the first 3 applied. The fifth is applied similarly to the fourth but begins farther back toward the heel. Now put on a gauze bandage, taking care to apply it about the foot and leg in the same direction as the adhesive plaster strips previously described. This gives us the opportunity of a further correction of the deformity at each turn of the bandage. Over all a figure of eight adhesive tape encircles the foot and ankle, completing the dressing.

This dressing should be changed every 5 days. In the interim the mother or nurse is instructed to press the foot upward 4 or 5 times a day, thus constantly improving the correction of deformity. By this means a correction is obtained in 6 months' time, after which a plaster-of-Paris dressing should be worn in order to retain the foot in the properly over-corrected position. When the child begins to walk, an elevation of  $\frac{1}{4}$  inch on the outer side of

the sole and heel of the shoe continues the corrective force, and is of the utmost importance in preventing a relapse.

*Congenital Calcaneus.*—With the foot held in extreme extension, or in other words, plantar flexion, apply 3 strips of adhesive plaster, beginning at the base of the toes and extending up the center of the sole, continuing over the heel and passing up the back of the leg. These 3 strips of adhesive plaster are firmly attached by a gauze bandage extending from the toes to the knee joint. With this simple dressing the foot is held firmly down in an exaggerated position of dorsal flexion. Such a dressing must be continued for several months, at the end of which time it will be found that the tendo Achilles has contracted to such an extent that the foot can no longer be displaced into the original deformity. The length of time of such treatment should extend for



FIG. 1.—A proper shoe for very young children. Note especially that its broadest part is across the toe.

at least 6 months. When the case is over 9 months of age, the heel of the shoe should be raised a full  $\frac{1}{4}$  inch higher than its fellow of the opposite side.

*Acquired Deformities due to Weightbearing.*—These make themselves manifest at any time in childhood beginning from the time the child first begins to walk and developing as the years pass by. The normal weightbearing line of strain passes through the knee joint a little to its inner side and through a line represented by the anterior crest of the tibia down through the ankle joint over the dorsum of the foot to the second toe. If, when the foot is functioning, that is, bearing weight, we find that this line of weightbearing strain is in no wise interfered with, the result will be a perfectly normal foot held in perfect relationship to the leg, a foot which will not give trouble and one in which foot strain is

unknown. On the other hand, when this normal relationship of the foot to the leg is altered, the foot immediately feels the effect of the body weight strain in the abnormal position, and accordingly begins to complain by the sensation of muscle strain.

I wish to call your attention especially to this group of cases which are the most common and which, unless checked up and properly treated, will finally result in the development of pronation and subsequently flat feet.

The symptoms complained of are those of general fatigue without any definite pains or even aches and without special attention being directed to the foot or leg. As the foot strain continues and the child adds weight, an indefinite aching feeling is complained of in the muscles of the leg. The child is less active than its playmates, lags behind in its regular childhood activities, is much more inclined to sit down than to run about, and the general condition is less robust because of curtailed outdoor exercise.

Upon examining these little patients, we find that as they walk the body weight strain passes down through the leg to the inner border of the foot instead of over the dorsum of the foot to the second toe. This is due to an exaggerated eversion or pronation of the foot. To prevent such a deformity from continuing and to correct these cases of footstrain after they have developed we must depend almost entirely upon the footwear of the child.

*Stockings.*—In studying the child's foot it is seen that its broadest part is across the toes. This should be taken into consideration when dealing with stockings as well as with shoes. It is exceedingly difficult, however, to obtain infants' and children's stockings that are of this shape. Our only safeguard is to prescribe a stocking which is longer than the foot. If a short stocking is worn for any length of time, the foot is cramped up in a most remarkable way and can be fully appreciated only when demonstrated by seeing the foot thus carelessly treated.

*Shoes.*—The proper shoe for a child's foot must necessarily have its broadest part across the toes. Unfortunately, many children's shoes are made considerably narrower at the toe than across the ball of the foot. The second point of importance is that the shoe should have a straight inside line. Furthermore, a narrow shank is essential. In addition to this, a broad flat heel is necessary. It need hardly be said that the ideal shoe is a laced shoe. These special features should be carried out in all children's

shoes. The shoe must fit snugly over the dorsum of the foot and about the heel. Unfortunately, the shoe manufacturers anticipate adult styles in the larger children's sizes. Young girls are apt to be inclined to wear what are termed "more stylishly fashioned footwear" at the sacrifice of their feet which oftentimes causes disastrous results later in life.

In answer to the many questions regarding sneakers, sandals, corsetsided shoes, slippers and the like:

First. Sneakers, generally speaking, induce weak feet.

Second. Sandals: The same statement can be made regarding sandals as has just been made regarding sneakers, namely, that the result of their wear frequently causes weak feet. On the other hand, it can easily be understood that a strong foot with-



FIG. 2.—Proper shoe for a child. Note inward swing of forefoot, narrow shank, broad heel, broad toe, straight inside line of shoe.

out any hereditary weakness, a foot which is held in perfect relationship to the leg, may wear either a sneaker or a sandal without the slightest detriment.

Third. Corsetsided shoes, per se, have no intrinsic value. If the foot is not sufficiently strong to support the body weight without stiffening of the sides of the shoe, this stiffening will never be sufficient to prevent deformities from occurring. It is at times of slight advantage to use a stiffened-side shoe in conjunction with a properly balanced shoe, of which the sole and heel have been previously altered to obtain proper foot balance.

*Foot Plates.*—The term "arch supporter" is a misnomer. A

foot plate is inserted in the shoe not with the primary object of supporting the arch of the foot but in order to hold the foot in that position in which perfect foot balance is obtained. Such arch supporters, for such a purpose, are seldom necessary in children. For example, in the case which so often presents itself, viz.: that of a child with flat or pronated feet due to relaxation at the astraguloscapoid articulation, an elevation on the inner side of the sole and heel of the shoe of approximately three-sixteenths of an inch will be sufficient to correct this deformity and result in perfect poise and balance. In the few exceptions in which it is impossible to control this proper relationship of the foot to the leg by the shoe, a small insert or foot plate can be used. When this is the case, such should be made from a plaster-of-Paris cast of



FIG. 3.—G. Q., age 11 years, before operation. Hereditary weak feet. Treated for five years with plates, shoes, etc., without any curative results.

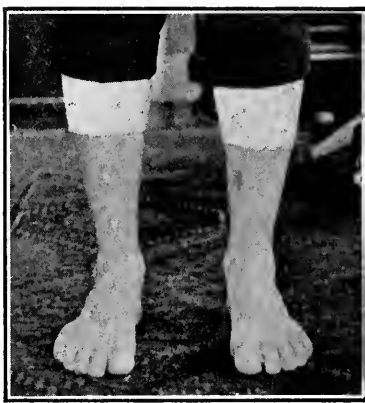


FIG. 4.—G. Q., same case, five years after operation, giving no symptoms of foot strain since the operation.

the foot and this plate should be very carefully remodeled to obtain the exact amount of correction necessary.

Before closing this exceedingly brief outline of a most important subject, I wish to call your attention to *a certain group of these cases which you will meet with which do not respond to the mechanical treatment above outlined*. These are cases of hereditary weak feet which cannot be cured by the proper application of either shoes or plates and in which the attempt of years of treatment proves of no avail. The condition of pronation remains unaffected so that when the child stands without shoes it is seen

that the body weight is thrown directly upon the inner border of the foot, just as it was before treatment was begun months or years previously, as the case might be. For these cases I have advised an operation of *arthroedising the astraguloscapoid articulation* (Jour. Am. Orthoped. Surg., June, 1919). By means of this operation, weak feet are transformed into strong ones, plates are discarded, and what is of the greatest importance, the child is endowed with feet which make for efficiency during the rest of life, in comparison to those which handicap and reduce efficiency to a minimum.

40 East 41st Street.

*Discussion.*—DR. DONALD E. MCKENNA stated: It is a pleasure to note the importance that is given to proper shoes in the treatment of static deformities by the reader of this paper. Improper shoes are the most potent factor in disturbing the normal anatomical relation between the leg and foot, and this is followed by muscle relaxation and ultimate bony distortion. Aside from the points emphasized in the criticism of the average commercial shoe, I would like to add the following: Too little consideration is given to the fact that the os calcis is convex on its inferior surface. The inner heel should be made concave to accommodate the contour of this bone. The forepart of shoe or in-sole, is usually concave. A slight convexity would be more in keeping with the anatomic contour.

If it is not too far afield let me mention a few conditions which simulate weak feet in children:—(a) Pseudo-hypertrophic muscular dystrophy; the first symptoms are often confined to the feet, but a careful history and physical examination and measurements will reveal an appreciable difference in the girth of the calves, etc. (b) Tuberculosis of the tarsal bones; x-ray diagnosis is unreliable in the early stages and in young children especially. (c) Syphilitic periostitis must be thought of, but we are not so apt to see cases where this is the predominating lesion. Infection being congenital and as a rule generalized, the diagnosis is not difficult. (d) Kohler's disease should be kept in mind even though it is rare. It is characterized by swelling, pain and tenderness; the cuboid bone casts an abnormally black shadow on the x-ray plate. It occurs in children from 4 to 6 years of age. It may be due to defective ossification or trauma or both. (e) Occasionally a case

of unrecognized poliomyelitis is met with. It may only be a weakness of the tibialis anticus muscle but a careful history will cause us to change the diagnosis. (f) The exanthemata often leave in their wake a condition of lowered muscle tone. Too hasty weight bearing produces undue strain and static foot troubles ensue. More caution in this particular phase is urged.

DR. WALTER TRUSLOW said: We should consider the etiology of this condition. I have taught that this can be expressed in the form of a simple equation, thus: A. If weight equals efficiency of feet, the result is normality. B. If weight is greater than efficiency of feet, the result is inefficiency.

A. *Increase of Weight.* The child, up to the time of putting weight on his feet, is only getting ready for weightbearing. Nature has placed the fat pad under his instep. If the child is over-heavy, the parent is cautioned to keep the child off his feet as much as possible. In later life, change of occupation may increase weight.

B. On the other hand, what will cause *Decrease of Efficiency*?  
1. Too tight shoes, keeping muscles from functioning; 2. Exanthemata, or anything else lessening tone of foot muscles. Here, either go slow, or give real support by a quickly-made brace, or by manipulating leather, i.e., building up heels and soles; 3. Infantile paralysis.

DR. MARSHALL C. PEASE, of Manhattan, said: From the standpoint of the pediatrician, such questions as these discussed by Dr. Ogilvy are of almost daily occurrence. We are apt to underestimate the claims on our attention of these "children that lag behind at the end of the day."

DR. M. T. KOVEN stated: In telling the mother how to have this alteration of the shoe made, direct her to have the leather beveled, and inserted between lifts or layers of heel and sole. In older children, especially girls with short heel-cords (tendines Achillis), dropping of the anterior arch occurs. This can be relieved by placing an anterior bar of leather transversely across the sole, behind the heads of the metatarsals. I have discussed this condition with Dr. Peek of Providence. He believes that much of this weakfoot is due to calcium deficiency. He has had success with small doses of thyroid.

DR. F. H. RICHARDSON said: What has especially appealed to



me has been the simplicity of Dr. Ogilvy's handling of this intensely practical subject. He has taught us to recognize the early phases of improper weightbearing in children, surely a most important part of the function of any man who deals with children. I have wondered, however, whether those of us who are not orthopedists are within our legitimate sphere when we attempt to make these manipulations of shoe-leather, as so many of us have done; or whether we are not sticking to the shoemaker's last for which we are not fitted and are not in fact treading upon the toes of the orthopedists? The other question which I should like to propose to Dr. Ogilvy, is, Where can we send our patients to get such shoes as we know they should have? Is there any store in greater New York where a mother can get for a child a shoe with the 3 requirements that he has laid down for us, and that we all recognize, namely: greatest width at the toe, inside straight line, and narrow shank?

DR. D. R. LLOYD stated: An estimate of the efficiency of the feet is a very plain proposition. Outlining of exercises, which every infant should have, even at first, is very important. Then, insistence upon a nap in the afternoon is most important, that is, the question of overfatigue. Then the child who is 15 or 20 pounds overweight at 3 or 4 years,—these are cases that should be studied from the general point of view. We must not stop at the feet, but must handle them from a broad viewpoint. These may be dietetic, or the cause may not be clear. Thyroid may help. The matter of feet must be followed up as carefully by the pediatricist or the general practitioner as the matter of feeding.

DR. OGILVY, in closing, said: In reply to Dr. Truslow's question in reference to heels. I quite agree with him that the surgical heel can be continued forward until it meets the sole. This, indeed, was the primary alteration made in shoes for this purpose by Thomas of Liverpool. The surgical heel is but a modification of this Thomas heel.

In answer to the question regarding plates. First, let me ask what a plate is and what is its purpose. Here I wish emphatically to state that it is not an arch support. Its purpose is to control foot balance and to keep the foot in a special proper relationship to the leg. This it accomplishes by perfectly controlling the foot in inversion and correcting its eversion. The only reason that a

plate is used is because the body weight is too great to be supported by an ordinary leather shoe and something stronger than this must be employed. In children a plate is rarely necessary for the reason that the body weight is not great enough to necessitate the use of the plate. The relationship of the foot to the leg and the proper foot balance can be perfectly well established and maintained by the alteration on the sole and heel of the shoe. Sir Robert Jones of Liverpool states that a plate, even in adolescence, is not only unnecessary but is objectionable and he never employs any plate whatsoever in these cases. If a plate of any kind is made, it should be discarded as soon as possible; that is, as soon as the same object can be obtained by the shoe alone, without the use of the plate.

Dr. Richardson's question as to whether or not he is treading on the toes of the orthopedic surgeon when he prescribes the proper shoe or special alteration on the shoe for his cases is very apropos. The answer to this question is that he certainly is not treading on our toes when he treats these cases. The very opposite is the case. The pediatricist and the general practitioner are responsible for the proper care of these children and should direct and supervise just such treatment. Nothing pleases me more than when a case comes to me which has in the first place been seen to and examined by the family physician in charge; secondly, has been prescribed for by that physician; and in the third place, and most important when the physician has seen to it that the prescription has been properly filled and a satisfactory result obtained.

Our aim is coöperation. Our object is to see that these children are prevented from developing such deformities as will cripple them in after life. Preventive measures are infinitely more laudable than corrective treatment which is necessary when preventive measures are neglected. As I stated in my paper, such responsibility is yours and mine and neither of us has any right to sidestep any such responsibility or to belittle the tremendous importance of how such an evasion of our duty reflects on the welfare of our patients in later life.

## ENURESIS\*

By WILLIAM E. CARTER, M.D.,

San Francisco.

The control of bed-wetting during childhood has presented **an irritating problem which has confronted physicians** since medicine first came into existence; the multiplicity of remedies prescribed speaks eloquently for their impotence in correcting this condition. A review of the work of the older writers gives one the impression that the field of drugs has been well-nigh exhausted **in the futile search for a cure.** The mechanical measures, which have been recommended for the relief of the condition, for the most part, are cruel and useless. It is not until recent years that the matter has been regarded with a critical view as to the etiology and pathology of the disorder, and like many other things in medicine, such consideration has changed our conceptions of treatment very materially.

During the seventeenth and eighteenth centuries, when medicine was still permeated with mysticism, the therapeutic procedures were as bizarre in this disorder as in others. So late as the nineteenth century, one medical writer, Lallemand, recommended an aromatic bath as a cure. He steeped a handful of aromatic herbs and added to the infusion a cup of brandy. This mixture was to be added to the bath and the child kept immersed for an hour daily for a period of several weeks. With this method he claimed many cures.

Throughout the early decades of the nineteenth century, when a forbidding parental sternness was considered essential to successful child rearing, corporal punishment as a cure for the disorder was advised by medical authors and no doubt it was recommended by practitioners and applied by parents with vigor. Two medical writers, Boerhaave and Caspar, went so far as to recommend as a cure the burning of the skin with hot irons. Another advised blows on the buttocks with the palm of the hand and seriously offered a "scientific" explanation that the local ischemia produced the desired result. The passing of sounds and the cautery of the neck of the bladder has added to the discomfort of many a hapless bed-wetting child.

Henoch believed the affection to be due to a local irritability

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\*From the Department of Pediatrics, University of California Medical School.

of the detrusor urinae but he could give no explanation; he was convinced however that a psychical element entered into the process as was evidenced by the clinical experience of injecting the gluteal region with drugs or even with "distilled water." He naively explained that "the patients were probably cured as they did not return to the clinic."

Forster, in 1860, was among the first vigorously to attack these practices, declaring them to be unjustifiable and cruel. "It is the surgeon's place to be the child's protector. The shame it suffers, if punishment were needed, is punishment enough." He further called attention to the fact that the fear of chastisement sometimes causes boy patients to place a tourniquet around the penis with a consequent production of gangrene and he illustrated a case with a wood cut in his admirably written book, "The Surgical Diseases of Children."

Medical thought has always turned toward local disturbances as etiological factors. Phimosis or long foreskins, with smegma retention, were thought to be causative and in many boy patients a circumcision has been unnecessarily done and in girls the clitoris has been ablated in spite of Buckingham's assertion that bed-wetting is as common a circumstance among circumcised Jewish children as it is in other children.

Among other methods of therapy in vogue was the "building up of the system" idea, by the administration of such tonics as iron and arsenic. This treatment was built on the theory that the disorder was due to debility, its proponents entirely overlooking the fact that enuresis is as likely to occur in sturdy children as in the debilitated, other things being equal.

Sir Dominic Corrigan advised an ingenuous method of treatment by elevating the hips during the night in order that the urine might fall back against the fundus and not forward into the neck of the bladder; this treatment was rational enough, but he spoiled his therapeutics by recommending that the prepuce and meatus in boys and the urinary meatus in girls be sealed with collodion.

Acidity of urine has been thought by some writers to be etiological; but it is observed that many children continue the practice after their urine has been rendered neutral or even alkaline. Intestinal parasites have been named as the cause and during the period when vermifuges were given indiscriminately,

often on a diagnosis made by the mother, many cases were improperly treated in this way. Constipation has received its share of accusation as a cause of bed-wetting, and aperients, ultimately aggravating the constipation, have been given, much to the detriment of the child.

The fact that many a child is known to have nocturnal incontinence of urine, when it is lying on its back during sleep, caused some one to recommend the fastening of a knotted towel on the body in such a manner that the knot comes in the middle of the back; the child is thus made uncomfortable should he attempt to lie in the dorsal position. This form of treatment was quite popular and it has been copied in many text-books since, in spite of the fact that its practicability is doubtful as such a contrivance usually refuses to stay in place unless the towel is so tightly applied that it interferes with respiration.

Results have been obtained under all these methods of treatment in quite a large percentage of cases, in many instances, probably, not because the local condition causes the incontinence, but because the psychic element of cooperation on the part of the child was brought into play, or because the disorder spontaneously ceased.

It is interesting to note in reviewing the literature on this subject, glimpses of rational therapeutics on the part of some men in spite of their lack of knowledge of the processes of the development of the nervous system. This is probably the result of a keen clinical insight, a sort of a "sixth sense," developed by some of these practitioners whose whole attention was directed to the clinical manifestations of disease and who were not distracted by the refinements of diagnosis.

Trousseau thought incontinence of urine to be a neurosis and he observed that it often occurs in families in which epilepsy is common. Eustace Smith, West and Sachs were among the first to sense the modern conception of the pathology of the disorder. Sachs, in 1896, called particular attention to the training of the nervous system as a cure for the affection. He mentioned that he had seen cases cured with no other therapeutic measures but he gave no explanation of how the thing occurred. Since that time, numerous authors have written exhaustively on the processes of inhibition and acceleration exercised by the upper centers over the lower, and of the paths over which such stimuli travel.

and of the development of such control. They have called attention to the well known fact that during infancy the lower centers only are involved in defecation and micturition and that, as the nervous system develops, there is an increasing control over this lower center and that complete function can be hastened through education by repetition. It is probable then, that in children, who continue this infantile process of urinary evacuation, the conducting paths function but in part and during sleep, the inhibitory stimuli are lacking. With this conception in mind, the treatment becomes obvious.

*Treatment.* All local morbid conditions should be discovered and corrected, not entirely because they may be etiological, but because their elimination is the proper thing to do for the general health of the child. Foci of infection, such as infected tonsils and alveoli, should be removed. An adherent prepuce requires operation. There is no indication however for a circumcision just because the foreskin happens to be long. If it retracts easily, it should be left alone. Highly acid urine should be neutralized or reduced in acidity by the administration of potassium citrate. This drug should be administered in 5 or 10 grain doses, every 2 hours, until the urine causes a strip of pink litmus paper to turn blue. Intestinal parasites, if they be present (and they are rare in American cities at least), should be expelled by appropriate drugs. Constipation should be overcome. High concentrations of urine should be corrected by giving plenty of water during the earlier hours of the day.

With all possible contributing factors removed, the major treatment of enuresis should be directed toward the training of the nervous system. As a requisite for undertaking treatment, a promise should be exacted from the mother or attendant of whole-hearted cooperation, for without this assistance treatment will be of no avail. It is perfectly useless to expect help from parents who are themselves so neurotic that they can not bear to impose any sort of discipline on their offspring.

The following special history blank and treatment for bed-wetting slip are used in the University of California Medical School, Children's Out-Patient Department. In private practice and in clinics this method of treatment is successful in nearly every patient, except the mentally deficient, where cooperation on the part of the mother or attendant can be obtained:

UNIVERSITY OF CALIFORNIA MEDICAL SCHOOL,  
Children's Out-Patient Department.

## SPECIAL HISTORY.

## Enuresis.

Name ..... Age ..... Sex .....  
 Address ..... O. P. D. Number .....  
 Has bed-wetting been continuous since birth? .....  
 Average number of nights per week the bed is wet .....  
 How soon after retiring is the bed found wet? .....  
 Does wetting the bed waken the child? .....  
 Does child sleep soundly or lightly? .....  
 Is the child nervous? .....  
 Does the patient take much fluid after 4 p.m.? .....  
 If boy, has the patient been circumcised? .....  
 Has the child ever been under treatment? ..... What? .....  
 Is there any history of worms? .....  
 Were the parents bed-wetters? .....  
 If so, how long did they continue the habit? .....  
 Is there a history of bed-wetting in other children of the  
 family? .....  
 If so, how long did they continue the habit? .....  
 Physical abnormalities .....  
 .....  
 Nutrition .....  
 Nervous system .....  
 Local findings (phimosis, vaginitis, etc.) .....  
 Urine: Sp. Gr. .... Reaction. .... Sediment .....  
 Remarks .....  
 .....

UNIVERSITY OF CALIFORNIA MEDICAL SCHOOL,  
Children's Out-Patient Department.

## TREATMENT FOR BED-WETTING.

Allow no fluid after — p.m.

Take the child up at — o'clock and again every — hours during the night and take him to the toilet. Turn the lights on and be sure he is thoroughly awake. (Wash his face with cold water to waken him if necessary). This step is very important.

After he knows where he is and what he is about, allow him to urinate.

Keep the foot of the bed elevated about 6 inches. (Wooden blocks under the foot posts.)

If the child can write, have him write each day on a piece of paper, "I did not wet the bed last night" or "I wet the bed last night," and bring the paper to the clinic on..... If he can not write, have him make a cross or a circle in place of the above sentences.

Once in the forenoon and once in the afternoon, take the child to the toilet and as he urinates, command him to "Stop"—"Start"—"Stop"—"Start"—"Stop"—"Start." This teaches him voluntary control of the bladder, the thing he lacks when he is asleep.

Success in the treatment depends almost entirely upon *how well the mother carries out these instructions.*

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It may be noted that fluid is not permitted after a given hour in the afternoon. This hour is governed somewhat by the character of the case, but ordinarily it is placed at 4 o'clock. The common practice of mothers of giving an infant 18 or 20 months or older a bottle of milk "to go to sleep on" must be sternly repressed. While the child is learning control of his urinary apparatus, it is well that he be given every advantage against the distention of the bladder and irritation at its neck. This latter is aided by Corrigan's idea of elevating the foot of the bed.

The next important step is in ascertaining, if possible, how often during the night the child wets the bed. This act must be anticipated by a few minutes and the child gotten up, thoroughly awakened so that he knows what he is about, and induced to urinate voluntarily. It is sometimes necessary to put a nurse or a reliable attendant on the case for a few days in order that this may be done properly. After a short period of time, it is usually unnecessary to take child up more than at the parent's bed time, and once again during the night. As the treatment progresses, it becomes unnecessary to take him up during the night and he finally, with an occasional failure, is able to go through the whole night with a dry bed.

Mothers sometimes ask how early in the child's life should



the education of voluntary urinary control be begun. The answer is by the end of the first year; and diurnal control, at least, should be completed not later than the eighteenth to the twenty-fourth month. A child of 2 or  $2\frac{1}{2}$  years old, who habitually wets his clothing during the day and the bed during the night, can not be said to be well trained.

After the child is 6 or 7 years old, his cooperation can be obtained by having him write each morning on a slip of paper on which the days of the week are written, "I wet the bed last night" or "I did not wet the bed last night." In a younger child, the same end may be attained by having him make a cross or a circle indicating success or failure. This slip should be brought or mailed to the physician each week. A prize should be offered for a whole week of success. (The gold stars, used by kindergarten teachers to paste on a correct page, are admirable for this purpose.)

In order that voluntary control can be gained, it is well to have the attendant call the child in from his play at least twice a day and teach him to inhibit and accelerate the urinary stream at such commands as "Stop"—"Start." We know of nothing that tends to educate voluntary control of the urinary center so promptly as this simple procedure.

Experience shows that there is little need for such drugs as belladonna and strychnine in the treatment of enuresis. However, there are cases in which one or the other of these drugs may play a useful part as adjunct to the training of the nervous system.

## THE NUTRITIVE RATIO OF THE INFANT'S RATION

By JOHN ZAHORSKY, M.D.,

St. Louis

Why not use the word ration to signify the baby's daily allowance of food? The term has been used by Schereschewsky and others, but does not seem to be generally acceptable. Yet we need just such a term; it is convenient and has been used for so long in the description of animal feeding and in the food of soldiers. Then why not use it when speaking or writing of the baby's diet? I have been using it for some time in my lectures and consider it a useful expression.

Then why not use the term maintenance ration to signify the minimum amount of food which will keep the bodily functions at work but produce no growth. It is so much more expressive than the simple term minimum diet used for this purpose. The name, maintenance diet, is also found in all scientific works on animal feeding; why not use the same expression in infant feeding? There seems no good reason for having a different terminology to discuss the feeding of animals from that used in infant feeding.

The term, nutritive ratio, is also used generally in all works on the feeding of animals. To me it seems the easiest way of expressing the relative quantity of protein in the diet. When we speak of an infant's ration having a certain nutritive ratio and a certain energy-quotient, we state definite facts in general scientific terms. The nutritive ratio expresses the ratio of the nitrogenous to the non-nitrogenous elements in the food. It is usually calculated by the following proportion: Percentage protein: percentage carbohydrate +  $2\frac{1}{4}$  percentage fat :: 1 : X.

In our method of percentage feeding, the nutritive ratio can be calculated in a few moments. Thus, if the baby is fed a mixture containing 1.5 per cent. protein, 2 per cent. fat, and 7 per cent. sugar, the proportion would be  $1.5:7+4.5::1:X$ . The nutritive ratio, therefore, is 1:7.6.

There are many different methods of expressing the relative amounts of protein in the food. Thus Cowie ascertains the amount of protein to the kilo of weight. Hess suggests a certain quantity of milk to the pound of weight. Dennett also uses the milk-

quantity in relation to weight. None of these methods are so comprehensive as the facts indicated by the term, nutritive ratio. Indeed, the relationship expressed by this term, whether used or not, is given a prominent place by most writers on infant feeding. (Rubner, Heubner, Camerer, Hoobler, etc.)

An examination of the various foods and food combinations used in infant feeding shows marked differences. The nutritive ratio of human milk, taking an average composition, is 1 to 13, a very wide ratio, which shows how sparingly nature is with the expensive protein substance. But the protein of human milk can be completely utilized by the baby; there is little waste either in the digestive apparatus or intermediary metabolism. All metabolic observations indicate that heterologous protein is assimilated only after a large part of the nitrogenous substance is wasted. Some of the component amino acid radicals of the protein are not needed by the human body; others are supplied in insufficient quantities and hence a larger quantity must be broken up to obtain the needed radicals.

Clinical experience, too, fully corroborates this theoretical fact. The infant, who has an insufficient amount of protein in its diet, shows certain symptoms—slow growth, anemia, muscular weakness and diminished resistance to disease. Yet it must be recognized that even when the nutritive ratio is very wide, the infant, by consuming a larger amount of food and by the utilization of the non-nitrogenous elements in the production of fat or energy, may make satisfactory growth.

A common food in which this frequently occurs is the milk preserve, sweet condensed milk. According to the accepted analysis (protein 8, sugar 55, fat 9.5), the nutritive ration would be about 1 to 9.5, a narrower ratio than that of human milk. If we accept von Pirquet's dictum (abstr. Am. J. Dis. Child.), then this condensed milk would be the ideal infant food. The American clinician, however, will not agree with this statement. The baby needs a diet whose nutritive ratio is at least 1 to 8. In fact, most infants thrive better when the nutritive ratio is 1 to 6, which corresponds to the common mixture of  $\frac{2}{3}$  milk and  $\frac{1}{3}$  water with 4 per cent. carbohydrates added. The minimum amount of protein is furnished by the half and half mixture with 4.5 per cent. sugar added (N. R. 1 to 8).

It is obvious that top milk mixtures always lower the nutritive ratio, and the poor results obtained from them may be at least partially explained by this protein starvation. For example, let us take a few common mixtures of top milk (or cream formulas) and calculate the nutritive ratio:

1. Protein 0.8 Sugar 7 Fat 3. N.R. 1 to 16.
2. " 1.1 " 7 " 3.5 N.R. 1 to 14.
3. " 1.1 " 7 " 2.3 N.R. 1 to 11.
4. " 1.6 " 7 " 3.5 N.R. 1 to 9.

It is plain enough that the cream mixtures yield a very wide nutritive ratio and their use is frequently followed by malnutrition, as is generally admitted, although the explanation offered, as a rule, places the blame on the fat. Compare plain milk mixture with No. 4 above.—

Protein 1.6, Sugar 7, Fat 2, N.R. 1 to 7.

Even  $\frac{1}{3}$  milk and  $\frac{2}{3}$  water, with 5 per cent. sugar added, is not worse than the  $\frac{1}{2}$  top-milk mixture.—

Protein 1.1, Sugar 6.5, Fat 1.5, N.R. 1 to 9.

An examination of other foods used at present by pediatricists discloses some curious relationships. Mixtures made from skimmed buttermilk have a very narrow nutritive ratio. A common mixture is  $\frac{1}{2}$  buttermilk,  $\frac{1}{2}$  barley water with 5 sugar.

Protein 1.7, Sugar 7, Fat 0.25, N.R. 1 to 5.

This is an ideal mixture to give babies who have been starved on protein. This diet often contains two-thirds buttermilk and the ratio is as follows:

Protein 2.2, Sugar 7.5, Fat 0.4, N.R. 1 to 4.

This is an ideal mixture to feed the starved cells and what is most important, increase the blood-volume, which is diminished in cases of malnutrition and inanition.

Casein buttermilk (Eiweiss Milch) has the narrowest nutritive ratio of all.

Protein 3.5, Sugar 2, Fat 3. N.R. 1 to 2.5.

But babies do not thrive on this, until more carbohydrate is added, about 4 per cent.

Protein 3.5, Sugar 7, Fat 3, N.R. 1 to 4.

This gives then a very narrow nutritive ratio and at the same time some fat which is not supplied in the skim-milk mixture. The deficiency of salts in the Eiweiss Milch seems to be compensated by an excessive formation of ammonia.

There is one milk-mixture the use of which is very successful in certain cases, namely, Keller's malt soup, the nutritive ratio of which is not narrow. As usually prepared it has about the following composition:

Protein 1.7, Carbohydrates 9, Fat 2, N.R. 1 to 8.

It is more correct, however, to add the protein contained in the malt soup and the flour to the protein. This gives:

Protein 2.5, Carbohydrates 9, Fat 2, N. R. 1 to 5.

which is probably nearer correct and really gives a narrow nutritive ratio.

A study of some of the proprietary milk foods shows little deficiency in protein. Only a few will be examined.

Nestlé's food                      Protein 14.3, Carb. 74, Fat 5.5, N.R. 1 to 6.

Malted milk                      Protein 16.3, Carb. 68, Fat 8.7, N.R. 1 to 5.

The low content of fat in these foods makes a narrow nutritive ratio, but their deficiency is clearly shown in their clinical use.

The introduction of dried milk has given us a food in which a very high nutritive ratio may easily be obtained. When no fat has been removed the nutritive ratio is that of cow's milk, 1 to 4. When one-half of the fat has been removed, the nutritive ratio is less than 1 to 3.

Without giving in detail case histories, I believe, my experience leads me to favor a narrow nutritive ratio (1 to 6). It is for this reason, more than any other, that I have almost abandoned the use of top-milk mixtures; it is hard to provide a sufficient protein when the fat content is high, and the correlation of these 2 food elements, at least in digestion, is a common experience. Fat delays the digestion of protein, and a delay in the assimilation of protein may be a serious thing to the young infant.

*Summary.* This paper is a plea for the more general use of the term, nutritive ratio, in infant feeding. The nutritive ratio of various common food mixtures is discussed and a suggestion made that a nutritive ratio of 1 to 6 should be maintained in artificial feeding.

*536 North Taylor Avenue.*

## INSTITUTION AND MAINTENANCE OF BREAST FEEDING.\*

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Can it be possible that in this present day of advanced medical education there can be even one physician who does not believe that mother's milk is the sole adequate food for the infant? However, recently artificial methods of feeding have occupied such a prominent place in medical literature, that perhaps our attention has to a degree been distracted from the best, the most obvious and natural method of feeding the infant, namely, maternal nursing. It would seem indeed academic to argue the advantages of breast milk before an assemblage of medical men. Let me limit myself to emphasizing 2 far-reaching facts.

During the first year of life, 6 times as many artificially fed babies die as breast fed. During the first year of life, the morbidity incidence of the bottle fed infant is many times as great as that of the breast fed, not to mention the later nutritional disturbances of the bottle fed to which the breast fed is practically immune. The obvious conclusions then must be:—that many babies die each year because they are bottle fed, and that, had they been breast fed, many of them would have lived; that many of the bottle fed babies, who do survive, would have had a much better opportunity for normal growth and development had they been breast fed.

In view of these incontrovertible facts, what are we going to do to prevent this avoidable infant mortality and morbidity? The answer to me seems quite simple. Every mother should be taught that she can and must nurse her infant, and it plainly rests with the obstetrician to take up his rightful rôle as "the mother's educator in breast feeding."

I firmly believe that if the mothers be properly advised, especially during the pre-natal period, fully 95 per cent. of them could and would nurse their infants. No one is in a more advantageous position to impress the mother with the importance of breast feeding than is the obstetrician. In addition to his usual instructions as to pre-natal care, he should assure the mother of her ability to nurse, and even more, to insist that it is the infant's inalienable right to be breast fed, and that the mother who fails to

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make every reasonable effort is derelict, and is robbing her child of its best opportunity for maximum growth and development. These facts must be so indelibly impressed on the mother's mind that when the infant arrives she feels that she must institute and maintain breast feeding at all hazards. Jacobi, Sedgwick, Griffith, Schwartz and many other competent observers assure us that agalactia or physiological failure of lactation is practically an unknown condition. It seems quite reasonable to assume then that if the proper psychological attitude of the mother be attained, that in nearly every case can breast feeding be successfully instituted. Let me again emphasize: 1. That practically every mother is physiologically able to nurse her young; 2. That the obstetrician during the pre-natal period must so care for the mother that she is physically and psychologically ready to carry out this function. Thus can the establishment of maternal nursing be assured and an excellent foundation for its maintenance laid.

Now, the mother is ready to learn the technique of nursing, upon the proper observation of which rests to a large measure successful lactation. I will not attempt to go into details such as the care of the breasts and nipples, position of child while nursing, etc., all of which points are so familiar to you, but I do wish to pronounce emphatically that the fundamental requirements for the stimulation and continuation of the milk flow is the complete and regularly repeated emptying of the breasts: 1. Three hour intervals; 2. Fifteen to 20 minutes at the breast, alternating breasts at each feeding. The careful observance of this dictum forms the greatest possible basis for the maintenance of breast feeding.

Let us then investigate the various reasons given for removing the baby from the breast according to the following classification: 1. Absolute indications; 2. Doubtful indications; 3. Indications frequently accepted, which are not true indications at all.

1. *Absolute Indications.* (a) Open tuberculosis, because of the danger of infecting the child, as well as because of the poor vitality of the mother seems to me a definite indication; (b) Breast abscess where the suppuration has been extensive; (c) Chronic nervous disturbances generally disqualify the mother; (d) The acute contagious as well as infectious diseases, such as typhoid, influenza, pneumonia and septicemia, while an indication for removing the child from the breast, are no indication for drying up

the milk. The breast should be stimulated regularly by extracting the milk by artificial means so that when the period of convalescence is reached breast feeding may be easy of reinstitution.

2. *Doubtful Indications.* (a) I am certain that I am in accordance with the belief of the best authorities when I say that menstruation is rarely, if ever, an adequate reason, although a popular belief to the contrary exists quite extensively; (b) Fissured or inverted nipples nearly always yield to careful and persistent treatment. Occasionally, however, the nipples are so badly fissured that it is advisable to remove the infant from the breast for a short time, reinstituting breast feeding as soon as the nipples are better; (c) An altogether too frequent reason given is that the mother's milk does not agree with the baby. Except in the rare instances where the mother's milk is actually injurious to the infant, some remediable cause can be found. A careful investigation will disclose that in most instances either the method of feeding has been faulty or the mother's habits of hygiene and diet are to blame. Correct these errors and the majority of babies who are brought to you for this complaint can be kept on the breast; (d) Condition of mother. I place this under the doubtful list because I believe that in many cases the nutritive state of the undernourished mother can be sufficiently improved to assure her ability to nurse her child.

3. *Indications Frequently Accepted Which Are Not True Indications At All.* (a) Mother unwilling to nurse her infant. I have very little respect for the mother who can but will not breast feed her baby; and I have not much more respect for the physician who will assist her to institute a substitute food; (b) Insufficient quantity of milk—milk too poor—baby does not gain. I wish to discuss these 3 under 1 heading because I believe that insufficient quantity is the real reason in all these instances, and because the remedy for all is the same.

How many times breast milk has been rejected as of too poor a quality on the meager evidence furnished by the examination of a single small specimen. I need only point to the recent exhaustive study of mother milk by Fritz Talbot, of Boston, in which he demonstrated that not only does the milk differ in composition at various periods of each feeding, but that it also differs as to quantity and quality at different times of the day and night, to show how unscientific and ill-judged such a conclusion



must be. I would deem the examination of a 24-hour specimen of mother's milk by a competent chemist necessary before attempting to pass judgment as to its quality, and I do not hesitate to add that very rarely will the examination reveal any appreciable variance from the normal. And further, how often has the weaning of a baby been advised because of the mother's statement that she has not sufficient milk without the necessary conclusive evidence gained by a weighing of the baby before and after each feeding for a period of at least 24 hours. If the infant is not gaining and the quantity of breast milk is thus found to be below the infant's needs, the complemental feeding of modified milk sufficient to make up the deficiency should be given immediately following each breast feeding. Even though the amount of breast milk be very small, it must be borne in mind that even small quantities of breast milk make cow's milk much more easily digestible. By no means should it ever be a substitute feeding, for such a procedure is the surest method of further diminishing the quantity of milk secreted. Frequently with careful attention to the mother's diet and hygiene her milk can be increased to an adequate quantity so that the complemental feeding may later be eliminated.

Just a few words as to the reinstitution of breast feeding. I have been able to bring it about in quite a few cases, even when the breast has been discontinued for as long a period as 6 weeks. There are 2 factors of paramount importance involved: 1. A willing and patient mother; 2. A regular, persistent, consistent and insistent demand on the breast.

In conclusion I would say that if we desire to insure for the future a maximum number of breast fed babies, we must teach our doctors-to-be that breast milk is the sole adequate food for the infant, and that just because many babies are successfully fed on artificial foods is no reason to substitute one of them until every effort to maintain breast feeding has failed; and this dictum must be carried by them to every mother in the land. I have not attempted in this paper to advance anything new, but have simply endeavored to emphasize certain cardinal points of infant welfare which have been seemingly slighted by many members of the medical profession, and with the earnest hope that it may stimulate a renewed activity in behalf of maternal feeding.

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## CLINICAL DEPARTMENT

CASES CONTRIBUTED BY

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CASE No. 11.\* Female, age 5 months.

*Family History.* During pregnancy mother had acute rheumatic fever. She is thin, pale and extremely neurotic. Father had chorea when 10 years old. A habit tic has existed since that time. The first child was premature and died when 12 days old. In the remote family history there is evidence of intermarriage. The maternal grandmother died of tuberculosis, aged 32. The maternal grandfather died of carcinoma of the stomach, aged 45. An aunt has given birth to 2 monstrosities. Two of an uncle's children are imbeciles.

*Personal History.* Full term, normal delivery, birth weight  $7\frac{1}{2}$  pounds. There was no history of convulsions or infectious diseases. The story was that of the usual athreptic. Nursing was discontinued at the second week and the usual attempts at various feeding methods were undergone. Vomiting was the chief trouble. It was never projectile, but of the regurgitant type, a considerable portion of each feeding being lost. The weight accordingly remained at a standstill. Restlessness, hunger, irritability and failure to gain in weight have been constant complaints since birth.

*Physical Examination.* Thin, pale, emaciated female, weighing 7 pounds, 11 ounces. Muscles were soft and flabby. The bony structures were apparently normal. Head was not enlarged; fontanel, 2 by 2 inches. There was marked evidence of extreme wasting. The eyes were sunken, the pupils reacted to light and accommodation. Conjunctivae pale. The tongue slightly coated. The throat, clear. No apparent glandular enlargement. The heart and lungs were negative. The abdomen flat and negative. The liver and spleen not palpable. A pyloric tumor could not be felt.

*Treatment.* We considered this to be either a case of simple pylorospasm or of hypermotility of the stomach. The extreme malnutrition was caused by the persistent vomiting. The mother was instructed to prepare a thick formula, as follows: 12 oz.

\*Failure to gain in weight, persistent vomiting with rumination.

whole milk; 18 oz. water; 6 tablespoonfuls of farina; 1 tablespoonful of granulated sugar; 1 tablespoonful of Dextri-Maltose.

In the preparation of this formula, the farina was added to 20 ounces of water. It was brought to a boil and then allowed to simmer in a double boiler for 2 hours. Milk was then added and the entire mixture cooked 30 minutes. While hot, the granulated sugar and Dextri-Maltose were added. Four ounces were spoon-fed at 3 hour intervals. Seven feedings were given daily. For 2 days the food was retained and the vomiting ceased entirely, then there was a recurrence. A part of each feeding was regurgitated immediately after the feeding. The vomiting was never projectile. Constipation was obstinate and, as a result, the mother found it necessary to use daily enemata. During these 4 days there had been a loss in weight of 3 ounces. In our office the child was given a feeding and watched. Immediately after taking the feeding the child began to ruminate. Her lower jaw became rigidly extended and the abdomen markedly retracted. The tongue was pushed against the lower jaw. Both sides of the tongue were curved upwards, leaving in the centre a deep furrow running antero-posteriorly. By a peculiar rhythmical movement of the tongue and jaw, the food was pumped up from the stomach into the pharynx and then forced into the open mouth. A portion of the food was expelled from the mouth and the remainder was held. A process of chewing followed and the food was then re-swallowed. The ruminating persisted for about one hour and at the end of this time approximately one half of the food had been expelled from the stomach. No mass was palpable at the pylorus and no stomach wave was visible. The nurse was instructed to keep the child's mouth closed by forcibly exerting pressure with her thumbs on both sides of the child's lower jaw. This procedure was to be continued for at least one hour after each feeding. The following formula was now given: 14 oz. whole milk; 16 oz. water; 6 tablespoons farina; 1 tablespoon granulated sugar.

Four ounces were given at 3 hour intervals, 7 feedings daily. The following week the child made a gain of 14 ounces in weight. Practically all the food was retained, and though she had struggled in her endeavor to ruminate, she seemed happier and there was marked improvement in her condition.

The 2 A. M. feeding was now omitted and again the nurse was instructed to carry out the same mechanical means of keeping the

child's mouth closed after feeding. At the next visit, a week later, the child had lost 2 ounces in weight. Ruminating and regurgitating had occurred because the task of holding the jaw was too great for both the nurse and the mother. Milk of magnesia in doses of 1 to 2 teaspoons daily had been given to relieve the constipation.

An alkaline powder consisting of 1 gr. of sodium bicarbonate, 1 gr. of bismuth sub-carbonate and  $\frac{1}{2}$  gr. magnesium carbonate was to be given before each feeding. The same formula was used and again they were instructed to prevent ruminating by manual force until a device to prevent the infant's peculiar manipulation of the lower jaw could be made. The following week was a repetition



CASE No. 11.—Picture illustrating mask for rumination, showing manner of applying it under chin. Note the buckles on top and the strap which runs posteriorly.

of the week preceding. The nurse and the mother were unable to cope with the situation; the task was too strenuous and they became discouraged. The child had lost 9 ounces in weight and the ruminating had not improved. She was restless, irritable and hungry. The weight was now 7 pounds, 9 ounces. A mask was now applied, and after readjustments absolutely prevented the extension of the lower jaw. The mask was worn continuously throughout the following week, during which time the child gained 10 ounces in weight and there was a decided change for the better. No ruminating or vomiting had occurred and all food was retained. The family lived in the country and had

doubts as to the cleanliness of the milk supply. The formula was accordingly changed to: 8 oz. Borden's evaporated milk; 22 oz. water; 6 tablespoons farina; 1 tablespoon granulated sugar; 1 tablespoon Dextri-Maltose, No. 3. This formula was prepared as before, Borden's evaporated milk being substituted for the whole milk. After an interval of 2 weeks, the child had made an additional gain of 18 ounces in weight. No vomiting or ruminating occurred while the mask was in position, but as soon as the mask was removed, which released the lower jaw, the ruminating began.

After an interval of 2 weeks, we again weighed the baby and found she showed an even 10 pounds. In 5 weeks, with the use of the mask, she had gained 2 pounds, 7 ounces. Without the use of some device, to prevent the manipulation of the lower jaw, the child would surely have died of starvation in a week or two.

C. G. KERLEY AND E. J. LORENZE, JR.

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CASE No. 12.\* Amyotonia congenita, also called myatonia congenita or Oppenheim's disease, is "a disease beginning at birth or early infancy, due to a congenital developmental defect of the lower motor neuron and of the voluntary muscles, clinically characterized by weakness, hypotonia and a quantitatively diminished electrical response in the muscles usually without disturbances of a sensation or of mentality" (Faber).

To date, 130 cases have been reported in the literature. Since 1900, when Oppenheim<sup>1</sup> first described the disease, the literature on the subject has accumulated so that now several extensive reviews are available, the most recent and comprehensive being those by Faber<sup>2</sup> and by Reuben,<sup>3</sup> in 1917. Faber reported 3 new cases and Reuben 6. One of the cases reported by Reuben, Case I of his series, is the same patient reported as Case II of mine. He saw this baby in consultation several times when about 5½ months old, whereas the baby was continuously under observation at the Infant Welfare Clinic of Lebanon Hospital from the time it was 6 weeks old until the time of its death at 39 weeks. It is also interesting to note in this connection that Case III of mine is a brother of the baby referred to above. With the addition then of my 2 new cases, the

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\*Amyotonia congenita, with a report of three cases.

reported cases now amount to 132. I have also seen 1 other case presented before the Pediatric Club of this city as a case of poliomyelitis, which I was able to prove to be a case of amyotonia congenita. Undoubtedly, as Faber has pointed out, many cases are erroneously diagnosed even in the literature.

CASE I. L. M., male child, 2 years old, came to the Infant Welfare Department of Lebanon Hospital, June 9, 1917, with the following history:—

*Chief Complaint.* Weakness of limbs.

*Family History.* Parents each 27 years old, in good health. Married 5 years. Have one other child, a girl 4 years old, who is normal in every way. No history of tuberculosis or syphilis.

*Pregnancy.* Mother had no prenatal disturbances. She remembers that fetal movements were not active until the ninth month.

*Birth.* Full term, normal delivery except that the baby was blue and it took one-half hour to initiate respiration. No record of weight at birth.

*Patient's History.* Breast fed for 13 months, after that general diet. Cried very weakly until 6 months old. Had convulsions on and off until 7 months old, especially after crying. Cut first tooth at 10 months, now has 18 teeth. Anterior fontanel closed at 14 months. Has had 2 attacks of pneumonia, the first at 9 months, and the second at 13 months, each lasting one week, with good recovery. Has been obstinately constipated since birth. Has no bladder control. He is not able to speak but mother thinks his mentality is improving. For the past 2 months, he has been grinding his teeth almost continuously, sometimes even in his sleep. Has good appetite. Has gained regularly and weighs to-day 24 pounds.

*Present Illness.* Mother noticed that he has been slow in his movements since birth. He could not grasp objects as other babies do during the first few weeks of life. Did not reach for objects until 10 months old. For the past 8 months he has been using his extremities more freely. He is not able to hold his head up or sit up.

*Physical Examination.* Presents a fairly well nourished male child lying on his back and making voluntary motions with his extremities which are weak, the lower limbs being more active than the upper. His skin is soft and hair fine.

*Head.* Expression of the face is very inert but there is no evidence of paralysis of the facial muscles when he cries. Fontanels closed, forehead high. Circumference 19 inches. No evidence of lues or rickets. Muscles about the eyes and mouth are apparently strong. No ptosis or strabismus. Pupils react promptly to light. Vision is good. There is no nystagmus. Ears and hearing normal. There are 18 teeth in good condition. Palatal arch is high. Mouth kept open due to presence of adenoids.

*Neck.* Neither thyroid nor thymus is palpable. Cervical lymph nodes are palpable.



FIG. 1.—Showing marked kyphosis when supported in the upright position.

*Chest.* Shape normal, no rosary present. No atrophy of intercostal muscles. Lungs normal. Thymus percusses normal.

*Heart.* Rate 92, size and sounds normal.

*Back.* Marked kyphosis of entire back. (Fig. 1.)

*Abdomen,* large; circumference 20 inches. Abdominal wall thin. Irregular doughy masses felt throughout, which pit on pressure, showing presence of fecal impactions in the bowel. Liver and spleen palpable but not enlarged.

*Lymph Nodes.* Axillary, inguinal and epitrochlear, not enlarged.

*Genitals.* No testicles present in scrotum.

*Extremities.* Muscles in all extremities feel soft and flabby. No apparent atrophy. Moves all the limbs, the lower more than the upper but is unable to support feet in the air. There is hypermotility at the wrist joints and at the metacarpo-phalangeal joints of the thumbs. Both middle toes are held flexed on the plantar surface and are overlapped by the toes adjacent to them. The feet are long and have peculiar puffy plantar pads at the heel which do not pit on pressure. These pads extend beyond the os calcis increasing the length of the foot. (Fig. 2.) There is also hypermotility of both middle toes and of both ankles.

*Reflexes,* all absent.

Blood Wassermann on both mother and child negative.

Electrical reactions kindly performed for me by Dr. Morris



FIG. 2.—Showing "pad foot" and overlapping of middle toe by two adjacent toes.

Grossman revealed an absence of the reaction of degeneration and also that more current than normal was required to produce contractions in the affected muscles.

*Subsequent History.* The patient's status remained practically the same until he was  $3\frac{1}{2}$  years old, when he contracted pneumonia for the third time and expired. Unfortunately no autopsy was obtainable.

CASE II. J. B. (previously reported by Reuben), female child was brought to the Infant Welfare Department of Lebanon Hospital when 6 weeks old for general care and feeding. At that time, neither the nurse nor the mother noticed anything wrong so that my attention was not directed to this infant until



she was about 5 months old. At that time, the following history was obtained:—

*Family History.* Parents are Russian Jews. Mother 29 years old, father 27. Married 4 years. No miscarriages. Patient is first baby. No history of tuberculosis or syphilis.

*Pregnancy.* Mother says she did not feel fetal movements much. Otherwise pregnancy was normal.

*Birth.* Supposed to be 2 weeks premature. Delivery normal. Easy labor. Weight at birth  $6\frac{1}{2}$  pounds.

*Patient's History.* Breast fed until 4 months old, when put on mixed feeding because the mother noticed that the baby tired very easily after nursing a few minutes and consequently was underfed. Mother complains that the baby does not use its lower limbs much nor turn its body. She thinks this condition has been present since birth. She considers the baby intelligent. The baby recognizes its parents and reaches for objects.

*Physical Examination.* A rather bright-appearing infant lying on its back. Cries as soon as approached by the physician but evinces pleasure when approached by the mother. The cry is thin and weak. Appears to be undersized but not emaciated. Body length at 6 weeks, 53 cm.; at 5 months, 56 cm. Skin is soft, hair fine.

*Head.* Posterior fontanel closed. Anterior fontanel about 2.5 cm. in diameter. Circumference of head at 6 weeks, 34 cm.; at 5 months, 41 cm. Expression of the face is normal, there appearing to be no weakness of the muscles when crying or smiling. Sight and hearing are apparently normal. Eyes and eye-grounds normal. Mouth and throat normal. No teeth.

*Neck.* Lymph-nodes not enlarged. The muscles of the neck are unable to support the head, the latter falling directly backward when the body is supported in the upright position.

*Chest.* Appears to be narrowed from side to side. Circumference at 6 weeks, 34 cm.; at 5 months, 35 cm. Slight retraction of the intercostal spaces noted on inspiration. Breathing almost completely abdominal. Heart and lungs normal. Thymus dullness not marked.

*Back.* Marked kyphosis of entire back noted when patient is supported in sitting position.

*Abdomen.* Circumference 37.5 cm., rounded and normal in

contour. Abdominal wall is soft and flabby. Liver and spleen palpable but not enlarged.

*Lymph-nodes*, not palpable.

*Extremities*. Voluntary motion in the upper extremities normal but not very active. The middle fingers are held flexed and are overlapped by the finger on both sides. Both ring fingers can be extended backward to an acute angle with the hand at the metacarpo-phalangeal joint. The lower limbs lie extended and are practically motionless. No apparent atrophy is present. The muscles feel soft and flabby. On pricking the soles of the feet with a pin, the child cries but makes no attempt to move the limbs except somewhat from side to side. The feet are elongated, there being present the so-called plantar pads described above.

*Reflexes*. All the usual reflexes absent. Babinski weakly positive.

Wassermann on mother's blood, negative.

The further history of this case extends to the 39th week, when the child died with pneumonia. Autopsy refused.

CASE III. D. B., brother of Case II, was seen by me a few hours after birth. He cried lustily and appeared to be using his limbs normally. The mother was extremely anxious to know whether this baby had any of the signs and symptoms from which her first baby had suffered, and at the examination, shortly after birth, I was able to assure her that I could find nothing wrong with the new baby.

*Pregnancy*. I had occasion to examine the mother several times during her pregnancy. The fetal heart sounds were always strong and the rate was about 150. She experienced quickening in time and in every other way appeared to have had a normal pregnancy.

*Birth*. Born at full term. Labor and delivery normal. Weight at birth,  $6\frac{1}{2}$  pounds.

*Subsequent History*. The patient was seen by me again, when 8 weeks old. He weighed then 10 pounds 5 ounces. Physical examination at this time revealed almost an exact reproduction of the action and appearance described above for his sister. He showed little motion of his upper extremities and none of his lower. His breathing was abdominal. His cry was weak. Fol-

lowing this visit, the mother left the city and I was unable to get any further trace of the patient.

In my cases the following symptoms and signs, more or less characteristic of the disease, are illustrated:—

1. Disability of the lower limbs. This was almost complete in all my cases and is a constant finding in all the reported cases. No matter what other muscles may be involved, those of the lower extremities are always involved.

2. Inability to sit upright was presented by the 2 older cases and is another symptom quite characteristic of the disease. It is due to involvement of the muscles of the back and those of the pelvic girdle.

3. Involvement of the intercostal muscles was one of the striking signs presented by Cases II and III of my series. It is not always present being found in only 15 of the reported cases and being mentioned as weak in 11 cases.

4. The absence of knee-jerks and other tendon reflexes, noted in my cases, is a feature in the majority of the cases reported. According to Faber, they were present in 26.6 per cent. of the cases on record.

5. Electrical reaction. This test was made only in Case I. It consists in a lessened quantitative irritability to both galvanism and faradism with at the same time an absence of the reaction of degeneration. Collier and Wilson<sup>4</sup> considered this reaction so characteristic of the disease that they termed it the myatonic reaction. Faber has however found the same reaction in 3 cases of mongolism and he uses this fact as one of the arguments in favor of the analogy between the 2 diseases.

6. Mentality. Only one of the 3 cases was mentally defective. This coincides with Faber's figures of 22.2 per cent. of the reported cases as being mentally deficient.

7. Abnormal mobility of the joints was present in all my cases and is one of the most constant findings in the disease.

8. Contractures. While no definite contractures were present in my cases, the peculiar attitude assumed by the middle toes in Case I and of the middle fingers in the 2 other cases were probably due to partial contractures of the flexor tendons of those particular digits. Contractures naturally constitute a part of the disease and have been reported as present in 81.8 per cent. of the cases.

9. The so-called pad feet presented by all my cases and illustrated by one of Faber's cases, was first noticed by Collier and Wilson and considered by them to be typical of the disease. This, as well as the flexion of the middle toe, is shown in Figure 2.

10. Convulsions are not common in this disease, being mentioned as occurring only 4 times in the reported cases. It occurred only in Case I of my series.

11. Of concomitant congenital defects, only Case I showed cryptorchidism, a condition reported only once before.

12. Radiography of the long bones in amyotonia shows thinning of the medullary substance with an apparent density of the cortex (Fig. 3). It is a sort of an atrophy from disuse and is therefore not peculiar to amyotonia.

*Pathology.* From a complete study of the necropsy findings, Faber concludes that it "gives one the definite conception of a failure of the peripheral motor neuron in its entirety to develop, and strengthens the analogy to Little's disease, to which Collier has drawn attention. With the exception of two early necropsies, these changes, differing in extent and severity to be sure, have invariably been found." Faber states it as his opinion "that the primary lesion of amyotonia congenita is a congenital hypoplasia of the lower motor neuron, believing that the muscular changes are secondary to this process, and that it will be found that the original fault is in the defective germ plasm of reproductively exhausted parents."

Specifically, the pathological findings in amyotonia are a fatty and connective tissue infiltration of the muscles involved, a deficient myelinization of the fibers of the peripheral nerves with an increase in the connective tissue of the peri- and endoneurium, a similar and more marked involvement of the anterior roots, a reduction in the cells of the anterior horn, an increase of the neuroglia of the cord and a lack of development of the motor nerve endings. No degenerative changes have been found in the muscles nor in the nervous structures. The posterior roots and posterior horn have never been involved and only exceptionally have there been reports of lesions of the brain, cerebellum or medulla.

*Prognosis.* Thus far no recoveries have been reported. Only one case has lived to 50 years, the oldest one reported before

that being Oppenheim's last case, which was 12 years old. Improvement has been noted in some cases. In Case I of mine there seemed to be periods of greater activity followed by relapses all depending on the general constitutional condition of the patient at the time. All of the cases die of some inter-current disease, the majority, according to Faber 90 per cent., being caused by pneumonia.

*Treatment.* One would expect that in a condition due to a developmental defect treatment would be of no avail. Thus far that seems to be true in spite of the many drugs, organotherapy and mechanotherapy that have been tried.

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JOSEPH POPPER.

CASE NO. 13.\* Female, 15 months old.

*Family History.* Negative. One older child, well.

*Personal History.* Full term. During the 5th month of pregnancy, mother was operated upon for uterine fibroid. Labor was normal and the birth weight was 7½ pounds. Patient was breast fed entirely for 3 weeks, and then, because of insufficient quantity of milk, supplementary feedings were instituted. At the age of 7 months she weighed 13½ pounds and was found well-nourished. Until this time there had been nothing noteworthy in her history. She now developed an attack of persistent vomiting, which continued for 3 days. During this time little water or food was retained. There was no elevation of temperature and there was no bowel disturbance. There were symptoms, however, which pointed strongly to pain in the head. There were frequent attacks of sudden crying with burrowing of the head in the pillow. The body would become rigid in the opisthotonus position. These seizures, which lasted a few minutes, were followed by periods of apparent unconsciousness, which lasted about ½ hour. The seizures and the vomiting ceased suddenly and the usual life was again resumed, the cause of the attacks remaining unexplained.

A week later, the fontanel appeared unusually prominent and the head measurement showed the circumference to be 16½ inches.

\*Convulsions, hydrocephalus.

The next measurement of the head was made one week later, and showed an increase to  $17\frac{3}{8}$  inches. During this week, she had been rather inactive, was more comfortable in her bed than elsewhere, and cried more than usual, but the nourishment was well taken and the stools were apparently normal. A measurement was again made the following week and showed the circumference to be  $17\frac{3}{4}$  inches, an increase of  $\frac{3}{8}$  of an inch in 1 week. The fontanel was now bulging. There was no gastrointestinal disturbance, no temperature elevation. She was apathetic, and cried when disturbed. There was an occasional piercing scream and then quiet.

An acute hydrocephalus was evident, and Dr. Alfred Taylor was called in consultation. His notes on the case are as follows:

Female; age  $7\frac{1}{2}$  months.

*April 5, 1920*, the head measured  $17\frac{3}{4}$  inches.

*April 6, 1920*, the right lateral ventricle was tapped and after 8 c.c. of spinal fluid was removed, 1 ampule of neutral sulphophenolphthalein was injected into the ventricle. Lumbar puncture was then done and the spinal fluid showed sulphophenolphthalein at 7 minutes after injection into the ventricle. The lumbar puncture needle did not enter the spinal canal until 7 minutes had elapsed and the fluid was already colored. Thirty-three c.c. of fluid was removed through the lumbar puncture needle and the anterior fontanel became contracted and pulsated. The fluid showed nothing abnormal. She immediately became very much better. The staring eyes retracted and became normal in appearance.

*April 9, 1920.*, 30 c.c. of spinal fluid was again removed and  $\frac{1}{2}$  c.c. of sulphophenolphthalein was injected. It appeared on the diaper at 12.30 P.M., 40 minutes after the injection. As a catheter was not used, excretion by the kidney undoubtedly occurred earlier than 40 minutes. She continued to gain steadily in every way without undue intracranial tension.

*April 27, 1920*, the head was  $18\frac{1}{2}$  inches in circumference.

*May 11, 1920*, the circumference was  $18\frac{5}{8}$  inches.

*May 12, 1920*, the child was frightened and cried strenuously and then had a convulsion which lasted 10 minutes. The head immediately became tense and the child restless. The head measured 19 inches in circumference. A lumbar tap was done with the removal of 88 c.c. of spinal fluid, which was slightly blood stained.

May 26, 1920, the head measured 19 inches. The tension in the anterior fontanel was somewhat increased and the child was not sleeping well. Forty-eight c.c. of fluid, which was perfectly clear, was then removed by lumbar tapping.

June 7, 1920, the head had increased to  $19\frac{1}{4}$  inches. Because of this continuous increase in growth of the head and the increasing tension, it seemed wise to do a puncture of the corpus callosum.

June 8, 1920, the corpus callosum was punctured through an incision in the anterior fontanel made under local anesthesia. The wound healed by primary union, the stitches being removed on the 7th day, and the child very much improved in every way. The head at this time measured  $19\frac{1}{8}$  inches. From this time on she made steady, uninterrupted improvement, and after a summer in the country came back looking absolutely well.

November 20, 1920, the child seemed perfectly well in every respect except that the head was slightly large in proportion to its body.

November 30, 1920, the child's condition is as follows: Weight 20 pounds 4 ounces; head circumference,  $19\frac{1}{8}$  inches. Child is bright and active, in every way a normal infant. Stands with assistance, is responsive and playful, tries to talk.

February 4, 1921. Since the last observation the baby has made satisfactory progress and appears in every way to be entirely normal.

C. G. KERLEY AND E. J. LORENZE, JR.

## SOCIETY REPORT

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### THE PHILADELPHIA PEDIATRIC SOCIETY.

*Stated Meeting, Held January 11, 1921.*

J. CLAXTON GITTINGS, M.D., PRESIDENT, *in the Chair.*

#### THE PHYSICIAN AND THE CHILD, Presidential Address.

In his address, Dr. Gittings defined a specialist as one, who, by special study, training and experience, has acquired more knowledge and presumably more clinical acumen in the diagnosis and treatment of certain diseases than has the general practitioner. The latter is enjoined from putting in a claim as a specialist so long as a major part of his time is devoted to the general problems of disease as it presents itself in adults. Instances were cited in general practice where simple ailments may be the beginning of serious or fatal disease and where the physician without any special training often fails to recognize the unusual in the guise of the every-day malady, or, having correctly diagnosed the original ailment, overlooks the development of a secondary or complicating disease. Other types of disease fundamentally easy of diagnosis remain unrecognized either from haste or from ignorance of pediatric practice, such as scurvy, pyelitis and so on. The principles of infant feeding are comparatively simple and easily learned, yet apparently many practitioners have decided to pass the trifling burden to the manufacturers of patent foods and condensed milk, who are so willing to assume it.

Pediatrics to-day stands as the only specialty which the average practitioner rarely is willing to give up. Either he should relinquish all claim to it or else, which is much better, prepare himself adequately for the responsibility. To accomplish this, it will be necessary to do one of two things, either to pursue a definite course of post-graduate instruction, or else to attach himself to a hospital which has an adequate pediatric service. If he be alert and progressive, by seeking contact with his fellows in the hospital forum and by study, he can easily fit himself to solve most of the problems in pediatrics. At the same time, he can keep so informed that he can render a like service to his adult patients.



Dr. Gittings' plea therefore was for a training of the general practitioner in the science and art of pediatric diagnosis and treatment, since a very large proportion of his practice will be among children.

For the beginner, the Health or Nutritional Clinic offers opportunity to learn the principles that underlie the maintenance of health, and methods of prevention of disease. Then there should come a service in a general medical pediatric clinic, which should be continued as long as the physician can spare the time. Under proper guidance and instruction, the habit of logical reasoning and accuracy in diagnosis is acquired. Nothing can surpass the value of proper history taking and complete physical examination. The recording of essential facts in the history and physical examination stamps indelibly the man of worth; failure to do so usually spells mediocrity. Rarely will a physician rise to great eminence who has failed either to acquire the capacity for detail or who has deliberately shunned it as uninteresting and, therefore, unimportant.

#### JUVENILE PARESIS.

DR. JOSEPH VICTOR KLAUDER read this paper in which he stated according to Leonard there were only about 250 cases of juvenile paresis on record. It is usually stated that the disease is rare. Since modern diagnostic methods have been applied to the spinal fluid, a great aid has been given in the diagnosis of obscure clinical cases which heretofore would doubtlessly have passed as epilepsy or as idiocy with epilepsy. If a neurotrophic strain of *treponema pallidum* is the cause of paresis, there are in all probability other and perhaps equally important factors in the causation of this disease. Psychopathic inheritance, alcoholism of the parents, cranial injuries have been given as the predisposing causes of juvenile paresis. It is of interest to note that the majority, if not all the causes which may be assigned in adults, are essentially lacking in the development of juvenile paresis.

Juvenile paresis is about equally divided between the 2 sexes. Cases reported have ranged from 5 years to late adolescence. Most frequently the disease appears between the ages of 8 and 12 years. The initial symptom may be mental or physical. The earliest mental symptoms are referable to changes in the character and intelligence of the child. To a strange and unusual be-

havior there is added a progressive dementia. Many of the early psychic disturbances in adult paretics are absent in the juvenile type. However, paresis in adolescence resembles in symptomatology the adult type. Delusions of grandeur are usually absent in the juvenile type and there is less of a distinction of the clinical types as seen in adults. Essentially the type of the juvenile paretic is the simple demented. At the time when one sees most of these cases they present the picture of imbecility with the somatic and laboratory picture of adult paresis.

The early symptom of juvenile paresis may be physical, an apoplectiform or epileptiform seizure. Or, first evidence may be symptoms referable to the motor apparatus, stumbling, ataxia, incoördination of movements. Convulsions are very frequent in the course of juvenile paresis. Of the somatic symptoms those of the motor apparatus are the most conspicuous and are frequently early in their appearance. Speech defect and pupillary abnormalities are invariably present. Optic atrophy as well as tabes are combined more frequently with juvenile paresis than in the adult form of the disease. The reflexes are often exaggerated. The course of the disease is from 3 to 5 years, which is a little longer than in adults.

Congenital syphilitic children may present the spinal fluid picture of paresis without having any clinical signs of the disease. These cases are probably in the "pre-paretic" stage of paresis. The blood Wassermann reaction in juvenile paresis is positive in almost 100 per cent. of cases. A negative spinal fluid would negative the diagnosis of paresis. The cell count is the only phase in the spinal fluid examination which may be normal; the count varies from normal to a few hundred cells or more. The globulin is always positive. In dilution as low as 0.1 c.c. of spinal fluid, the Wassermann reaction is positive. A definite paretic gold curve is characteristic.

Dr. Klauder presented case histories which showed the variable symptomatology of the disease.

#### REPORT OF A CASE OF GAUCHER'S DISEASE.

DR. H. BROOKER MILLS presented this case, with a description of the operation by Dr. W. Wayne Babcock and the pathological report on the spleen by Dr. Eugene J. Asnis. The patient was a 3

year old Italian child with an enormously enlarged spleen and a considerably enlarged liver. He presented so many of the classical symptoms of Gaucher's disease that the diagnosis was made clinically and a splenectomy done. He made a good recovery from the operation but died suddenly one month later from some unknown cause.

*Discussion.*—DR. EDWARD WEISS said that a case very similar to the one presented was autopsied recently at the Jefferson Hospital. The patient, a young Italian adult, had an immensely enlarged spleen which at autopsy weighed over 2,000 gms. On microscopic examination, the spleen presented the usual picture of Banti's disease, but the paraortic lymph-nodes, which were likewise enlarged, showed dilated sinuses filled with large cells possessing a pale vesicular cytoplasm and from 1 to 4 or more nuclei. These were felt to be Gaucher's cells and slides were submitted to Dr. Mandlebaum, who has made such a complete study of Gaucher's disease. Dr. Mandlebaum stated that he felt positive the case was not one of Gaucher's disease but was unable to identify all of the peculiar cells mentioned in the sinuses of the lymph-glands. He mentioned the grouping of cells in the alveoli as the distinctive features and this together with the unique character of the cytoplasm and the multiple nuclei will be of most service in establishing a correct diagnosis of Gaucher's disease.

#### THE REFLEXES IN EARLY INFANCY.

DR. CHARLES W. BURR presented this paper in which he reviewed the literature on this subject. There are practical difficulties in testing the reflexes in babies not present in older people. The new-born and the young infant are in a state of almost constant movement, except during sleep, on account of the numberless stimuli from within and without—stimuli to which older children pay no attention. Further, if the leg is held by the examiner while trying to get, say, the plantar jerk, the infant often immediately and persistently resists (holds the leg in rigid flexion or extension) and hence the reflex does not appear. The patellar tendon is very small in babies and to percuss it is not always easy. In a crying baby often no reflex movement can be obtained on account of the general muscular rigidity while in the same baby at rest all reflexes may be prompt. Curiously enough, muscular

contraction in other parts of the body (the leg remaining relaxed) did not reinforce the knee jerk, e. g., if a child grasped something vigorously in its hands while the knee jerk was being taken, the response was neither quicker nor more rapid, nor did the foot go through a larger arc than when the child was at absolute rest in those children examined by Dr. Burr.

The children examined were all free from disease of the nervous system save one who was 9 days old and who had a congenital peripheral facial palsy, they numbered 69 in all. From his study and observations he concluded: 1. The deep and superficial reflexes (i. e., knee, Achilles, chin, plantar, abdominal) may be present at birth, but the absence of one or all in early infancy does not indicate disease. 2. The plantar jerk is very variable. It may be absent up to the third month, or longer, or there may be extension or flexion of the toes, or at one time there may be one movement, at another, the other. Most frequently there is extension. The movement may be rapid or deliberate. 3. The Achilles jerk is very frequently absent at birth. How late in life it may appear is unknown. 4. Sometimes the abdominal jerk can be obtained only on stimulating the lowest third of the muscle. 5. Whether the occasional absence of the knee jerk in healthy adults (1-500) is congenital or the result of disease in early life can not be decided in the absence of a complete medical history. Diphtheria may permanently abolish it without persistence of other signs of nervous involvement. 6. When the reflexes appear after birth, their appearance does not occur in any regular order.

## BOOK REVIEWS

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QUICKSANDS OF YOUTH. BY FRANKLIN CHASE HOYT, Presiding Justice of the Children's Court of the City of New York, New York. Charles Scribner's Sons, 1921.

The average practitioner doing children's work oftentimes loses sight of child psychology and stresses the physical side of a child's development rather to the disadvantage of the mental side. This book is not a medical book but should be read by physicians for two reasons: First, because the problems presented are distinctly an important part of our social problems of the day; and second, because it is well written and interesting. It is a compilation of nine chapters, each chapter representing an actual incident taken from the records of the Children's Court, and all bound together to point a moral, and to adorn a tale. We, as pediatricists, have first chance at these juvenile delinquents and it is a salutary thing for us to realize our manifest shortcomings. In addition, this book was passed upon by the late Col. Roosevelt and many suggestions of his were carried out. It is a well worth while book.

SCURVY, PAST AND PRESENT. BY ALFRED HESS, M.D. Clinical Professor of Pediatrics, University and Bellevue Hospital Medical College, New York City. Illustrated. Philadelphia and London. J. B. Lippincott Co., 1921.

Vitamines, those intangible substances so essential to growth and nourishment, are at present occupying a large space on the stage of medical endeavor. It is therefore of the highest interest to review a book on a disease which is definitely caused by the lack of a specific vitamine. Whether or not rickets is brought on by the absence of fat soluble—A vitamine, or whether it is due to bad hygiene, is still a mooted question. Scurvy, however, does not fall under this category and when one reads Dr. Hess' book one realizes these essential facts. As stated in the preface by the author, there has been no treatise on scurvy published in English since 1772. It is therefore most timely for such a compendium to appear. The book is the result of 7 years' work and represents an exposition of the author's ideas on the juxtaposition

and correlation of these so-called accessory food factors, or vitamins, to the essential food substances, the fats, carbohydrates, proteins and salts. It contains 11 chapters with a preface, a bibliography, 25 illustrations, and 6 tables, and contains in its 280 well-written and crowded reading pages, a mass of data necessary to the understanding of this interesting nutritional condition. Of especial interest to the reviewer were the chapters on the history of scurvy, and experimental scurvy. The book is authoritative, exhaustive, and timely, and will be well received.

THE HEALTHY BABY. THE CARE AND FEEDING OF INFANTS IN SICKNESS AND IN HEALTH. BY ROGER H. DENNETT, M.D., Instructor in Diseases of Children in the New York Post-Graduate Medical School; Assistant Attending Physician to the Babies' Wards in the New York Post-Graduate Hospital; Chief of Clinic in the Post-Graduate Dispensary for Children; Fellow of the New York Academy of Medicine. New York. The Macmillan Co., 1919.

Dr. Dennett's method of teaching post-graduate students crops out in this small size edition of his larger book, and in particular does this apply to his method of simplified feeding. He advocates the very simplest formulae made of milk, water and sugar. In his opinion, the doctor should be consulted in all cases where the food is not being assimilated. There are so many books of instruction for the long-suffering mother that an author necessarily finds it hard to be original. All he can hope for is to present his case in a thorough and easily understood way, and to the reviewer's mind, this the author does. Of particular interest are the various tables and memoranda appended at the end of the main subject matter.

OUTLINE OF COMMON SKIN DISEASES, INCLUDING ERUPTIVE FEVERS. BY T. CASPER GILCHRIST, M.D. Also Diet Plans for Children, in use in the Department of Pediatrics of the Johns Hopkins Hospital. Third edition. Baltimore. The Students' Book Store, 1920.

The first part of this pocket size book consists of 34 concise pages in the form of a syllabus, or short cut to learning, and is primarily designed for the student of dermatology. However,

for one who is unwilling to wade through a manual of dermatology to find his needed point, here is the book for him. The scheme presented is a modification of Hebra's classification and includes 10 subheads. A short method to be used in making an examination is then presented, including under this: Duration, distribution, character, subjective symptoms, general symptoms, etiology, general pathology, and diagnosis. The common diseases of the skin are classed according to their primary lesions. A special list of those skin diseases inherent to children follows, and a general plan of diet, as followed in the Harriet Lane Home for Invalid Children for feeding children from 1 to 5, ends an interesting little book of the *vade mecum* type.

NERVOUS AND MENTAL DISEASES. BY ARCHIBALD CHURCH, M.D., Professor of Nervous and Mental Diseases in the Northwestern University Medical School, Chicago; formerly Professor of Neurology in the Chicago Polyclinic; Neurologist to St. Luke's, Wesley, Mercy, and Michael Reese Hospitals, etc. AND FREDERICK PETERSON, M.D., Ex-President of the New York State Commission in Lunacy; formerly Professor of Psychiatry, Columbia University; Consulting Alienist, Bellevue Hospital; Manager of the Craig Colony for Epileptics at Sonyea, New York; Ex-President of the New York Neurological Society. With 300 illustrations. Ninth Edition, thoroughly revised. Philadelphia and London. W. B. Saunders Co., 1919.

This standard book, first published in 1899, is here presented in its ninth edition. It is a classic of its kind and little need be said of it, as it is so generally and favorably known to the profession. In general there are no radical changes from the previous edition. The subjects of General Paresis and Traumatic Insanity, however, have been rewritten. Of especial interest to pediatricists are the sections on "Cerebral Palsies of Children"; "Glandular Neuroses"; "Idiocy"; and "Dementia Praecox". As a book of reference (949 pages), for student and practitioner, it is unexcelled.

THE MILK QUESTION. BY M. J. ROSENAU, M.D., Professor of Preventive Medicine and Hygiene, Harvard Medical School; formerly Director of the Hygienic Laboratory, United States

Public Health and Marine Hospital Service, Washington, D. C., Boston and New York. Houghton, Mifflin Co.

To a pediatricist it is always a pleasure to review such a book as Dr. Rosenau's. True, the book has been published for some years, but the subject is always new, and is one which should constantly be in our thoughts. It is frank propaganda for the basic element of our infants' dietary, an element which pervades the whole structure of preventive medicine, and which comprises a problem which touches humanity in every phase of its social fabric. We should consider milk as the emblem of purity and it is always a shock to the cognoscenti to realize that its pure whiteness covers dark and potent dangers. It is for this reason that the book should be read. Of especial interest are the illustrations which catch the eye of producer and consumer. The chapters range from "General Considerations" to one on "From Farm to Consumer." The references are particularly valuable and one reaches the conclusion that the only satisfactory solution of the problem is supervision and pasteurization of our milk supply. ARCHIVES OF PEDIATRICS takes great pleasure in endorsing this book heartily.

MOUTH HYGIENE. A Text-book for Dental Hygienists. Compiled and edited by ALFRED C. FONES, D.D.S., Bridgeport, Connecticut. Second edition, thoroughly revised. With 218 illustrations and 8 plates. Philadelphia and New York. Lea and Febiger, 1921.

To the mind of the reviewer, a book which represents the united efforts of the best minds on any one given subject, is very apt to present that subject in a highly conclusive and authoritative manner. Naturally, it must be well edited. In other words, a system written by a number of men covers more ground in a more specialized way, than a one man book. For this reason, Dr. Fones' text-book hits the high spots, as it is the joint work of men specializing in mouth hygiene in Bridgeport, Philadelphia, Boston and New York. Not the least of its many good points are its manifold illustrations, the sections on malocclusion, dental prophylaxis, dental caries, and the relation of oral infections to health. To the pediatricist, these are most important, and it is a field to which his attention will be drawn more and more in the future, if he has the welfare of his patients at heart.



EPIDEMIC ENCEPHALITIS (Encephalitis Lethargica). By FREDERICK TILNEY, M.D., Ph.D., Professor of Neurology, Columbia University; Attending Neurologist, the Presbyterian Hospital and the New York Neurological Institute; Consulting Neurologist, Roosevelt Hospital, New York, AND HUBERT S. HOWE, A.M., M.D., Instructor in Neurology, Columbia University; Assisting Visiting Neurologist, the Presbyterian Hospital, New York. New York. Paul B. Hoeber, 1920.

Any epidemic disease of an unusual nature naturally excites the greatest interest. Such a disease is so-called "encephalitis lethargica" which has been prevalent in this country during the past 2 years. In their brochure the authors have successfully collected a sufficient number of cases to correlate divergent clinical findings, and to mould the disease in a clinical entity. They describe 20 cases among which 8 fairly well defined clinical types have been recognized. They are: the lethargic, the cataleptic, the paralysis agitans, the polioencephalitic, the anterior poliomyelitic, the posterior poliomyelitic, the epilepto-maniacal, and the acute psychotic types. Of the greatest interest is the detailed study of these cases with complete notes, and clinical and pathological studies of selected cases. It is a very timely book in every way.

FRENCH-ENGLISH MEDICAL DICTIONARY. By ALFRED GORDON, A.M., M.D. (Paris), Late Associate in Nervous and Mental Diseases, Jefferson Medical College; Late Examiner of the Insane, Philadelphia General Hospital; Neurologist to Mt. Sinai, to Northwestern General and to the Douglass Memorial Hospitals; Member of the American Neurological Association, etc. Philadelphia. P. Blakiston's Son and Co.

It is always hard to review a dictionary as they are usually cut and dried affairs of precision. This one differs from the others in that it attempts to teach the reader phonetic pronunciation of medical French. For this purpose a key to pronunciation is inserted. The book is especially important on account of the necessity of appreciating the vast mass of data accumulated by French medicine during the world war. The only criticism, if any, which the reviewer might offer would be the lack of a corresponding English-French list of words. In other words, one can translate from, and not into, the French by its use. The worth of the book, however, overshadows this minor criticism.

MOTHER AND CHILD. BY EDWARD P. DAVIS, A.M., M.D., Professor of Obstetrics in the Jefferson Medical College; Visiting Obstetrician to the Jefferson and Philadelphia Hospitals; Consultant to the Preston Retreat, etc. Fourth Edition Revised. Philadelphia. J. B. Lippincott Company, 1921.

This book is a combination which should appeal to both the obstetrician and the pediatricist, in that over 90 pages are devoted to ante-natal care, and the remaining pages to post-natal care. It is simply written, is copiously illustrated with 33 illustrations, and has been sufficiently well received in the past to warrant a fourth edition. An infant's dietary is appended to the main subject matter. Needless to say, it is well printed, well bound, and, taking it all in all, fills its own little niche.

VITAMINES—ESSENTIAL FOOD FACTORS. By BENJAMIN HARROW, PH.D., Associate in Physiological Chemistry, College of Physicians and Surgeons, Columbia University, New York. New York. E. P. Dutton and Company, 1921.

To realize the importance of this popular presentation of an engrossing subject, one must be cognizant of the fact that the absence of vitamins makes life impossible. During all these years we have been eating vitamins, without knowing about them, but it is only since 1910 that the huge volume of work done has added enormously to our knowledge of the science of metabolism and nutrition. And it is largely through the efforts of men such as Funk, Mendel, McCollum, Osborne, Hess and Mellanby that we know what we do about the 3 common types of vitamins. The book itself is a good one for the professional man and the layman. It is written in simple, easily understood language, and covers the subject thoroughly without being too encyclopedic. A very practical summary concludes the book and emphasis is laid upon the future of the subject. An appendix which includes a table of composition and caloric value of the more important foods, and one showing the distribution of the 3 accessory factors (vitamins) in the commoner foodstuffs, will prove of great value to the clinician and to the dietitian. Not the least interesting of the chapters is the one on the history of the vitamins. We recommend it highly as a popular presentation of a very interesting subject.

NUTRITION AND CLINICAL DIETETICS. BY HERBERT S. CARTER, M.A., M.D., Assistant Professor of Medicine, Columbia University; Associate Attending Physician to the Presbyterian Hospital; Consulting Physician to the Lincoln Hospital, New York, PAUL E. HOWE, M.A., PH.D., Associate in Animal Pathology, Rockefeller Institute for Medical Research; formerly Assistant Professor of Biological Chemistry, Columbia University, New York; Nutrition Officer, Camp Kearney, California; Officer in charge of Laboratory of Nutrition, Army Medical School, Washington, D. C., AND HOWARD H. MASON, A.B., M.D. Instructor in Diseases of Children, Columbia University, New York; Associate Attending Physician to the Presbyterian Hospital; Attending Physician to the Ruptured and Crippled Hospital, New York. Second Edition, thoroughly revised. Philadelphia and New York. Lea and Febiger, 1921.

It is a recognized fact that over 75 per cent. of a pediatricist's practice falls into the domain of feeding. It is therefore obvious that unless one is able to be a successful feeder, one is not a successful pediatricist. And one cannot be a successful feeder, especially in difficult cases, unless he realizes certain basic facts concerning the food elements, and their relation to digestion, absorption and excretion. The reviewer feels that this is achieved in this present volume. It is a comprehensive work of 700 pages, of which over 40 are devoted to feeding in infancy and childhood alone. The first 250 pages, however, come under the realm of pediatrics as they include chapters on digestion, energy requirement, protein requirement, inorganic salts and water, food requirements in pregnancy and lactation, food requirements and feeding of children, fasting, normal feeding and food economics, milk, and all the various foods. It should also appeal to the internist and to the surgeon. Of particular value are the tables of food values and weights and measures. Nothing but good may be said about this interesting and well-worth-while book.

DERMATOLOGY. *The Essentials of Cutaneous Medicine.* BY WALTER JAMES HIGHMAN, M.D., Chairman, Section on Dermatology and Syphilology, American Medical Association; Member of the American Dermatological Association, and New York Dermatological Society; Associate Professor of Dermatology, New York Post-Graduate Medical School and Hospital; formerly In-

structor in Dermatology, Cornell University Medical School; Acting Associate Dermatologist, Mt. Sinai Hospital, New York; Adjunct Dermatologist, Lenox Hill Hospital, New York; Pathologist, Department of Dermatology, Vanderbilt Clinic, New York, etc. New York. The Macmillan Co., 1921.

A book on such a subject as dermatology is necessarily a hard one to write, and harder to review, as even among dermatologists there exist such radical differences of opinion in regard to this specialty. It is equally hard to present the subject in a clear, concise manner, free from all technicalities and abstractions. The average practitioner does not care about, nor indeed does he have the time for literary citations, or for histological or pathological data. What he needs and asks for is the absolute minimum necessary for him to learn his subject. As a matter of fact, there are over 400 more or less distinctly established skin conditions, and of these he is not concerned with perhaps more than 50 to 100 at the most. These more important conditions are accordingly emphasized, and are fully illustrated by well chosen pictures. Each disease is presented didactically and in the manner of one who has had experience in teaching post-graduate students. It is distinctly *not* a book of reference, quite the reverse. The reviewer feels that the author lives up to his dictum that the true dermatologist is an internist who knows the skin. And that is a point which is oftentimes lost sight of in these days of ultra-specialization.

TYPES OF MENTAL DEFECTIVES. BY MARTIN W. BARR, M.D., Chief Physician, Pennsylvania Training School for Feeble-minded Children, Elwyn, Pa., AND E. F. MALONEY, A.B., Professor of English, Girard College. With 31 plates containing 188 illustrations. Philadelphia. P. Blakiston's Son & Co., 1920.

This is a splendid manual of 175 pages which gives easily understood information as to how to recognize various forms of mental defects. It follows closely along the lines of the educational classification of mental defectives, and accomplishes its purpose by citing numerous case reports of each type and sub-type. The illustrations are exceptional and numerous, and especial attention is paid to the various grades of mentality and to their future development. For these reasons the book should find a ready sale.

THE DAWN OF MODERN MEDICINE. An Account of the Revival of the Science and Art of Medicine Which Took Place in Western Europe During the Latter Half of the Eighteenth Century and the First Part of the Nineteenth. BY ALBERT H. BUCK, B.A., M.D., formerly Clinical Professor of Diseases of the Ear, Columbia University, New York; Consulting Aural Surgeon, New York Eye and Ear Infirmary, etc. New Haven. Yale University Press, 1920.

This worthy companion piece and younger brother of Dr. Buck's first book "The Growth of Medicine" will appeal to the man interested in the historical side of the profession. And one will add to his knowledge of medicine by reading it, for it is on the efforts of these pioneers that modern medicine is predicated. It is necessarily frankly biographical, but the personal side of the man is not emphasized as much as his medical contributions. The book itself carries on from 1760 to approximately 1830, and barely touches on American medicine, which at that time was in a chaotic state, and in the process of formation. One realizes when reading this book what giants there were in those days, and how protean was their knowledge along accepted lines. Botany, for example, was frequently combined with anatomy and surgery; chemistry with physiology; and so on. Of especial interest to the reviewer were the chapters on small-pox and vaccination; medicine at the height of the French Revolution; and the biographies of Van Swieten; John and William Hunter; and Priestley and Lavoisier. Dr. Buck is to be congratulated for this sterling work.

PRACTICAL PREVENTIVE MEDICINE. BY MARK F. BOYD, M.D., M.S., C.P.H., Professor of Bacteriology and Preventive Medicine in the Medical Department of the University of Texas; Passed Assistant Surgeon (Reserve), U. S. Public Health Service; formerly Epidemiologist of the Iowa State Board of Health and Associate Professor of Preventive Medicine in the College of the University of Iowa; Charles Follen Folsom Teaching Fellow in Hygiene, Harvard Medical School. 135 illustrations. Philadelphia and London. W. B. Saunders Co., 1920.

This very practical book is divided into the following sections: Diseases due to Invading Microorganisms; Epidemiology;

Deficiency Diseases; Occupational Diseases; Special Aspects of Hygiene and Sanitation; Demography; and Public Health. As to the book's scope one may do worse than by quoting from the author: "Preventive medicine may be defined as that branch of applied biology which seeks to reduce or eradicate disease by removing or altering the responsible etiological factors. Included within its scope are two subjects which are often confused with it, these are hygiene and sanitation respectively." The book covers these branches in a very thorough fashion, and is well written and profusely illustrated. It is an authoritative compend.

ORTHOPAEDICS FOR PRACTITIONERS. An Introduction to the Practical Treatment of the Commoner Deformities. By PAUL BERNARD ROTH, M.B., Ch.B. (Aberd.), F.R.C.S. (Eng.), Senior Surgeon, and with charge of Orthopaedic Cases, Kensington General Hospital; Member of Orthopaedic Section, Royal Society of Medicine; Late Surgeon, City of London Military Hospital; Senior Orthopaedic Clinical Assistant, London Hospital, etc. London. Edward Arnold, 1920.

While it is true that the average practitioner has neither the time nor the inclination to delve deeply into orthopaedic surgery on account of its being a specialty apart, yet there are certain orthopaedic conditions which, if recognized early, he can treat easily and satisfactorily. In this category would come flat foot, scoliosis, and the various fractures and dislocations. All these conditions are fully covered in Dr. Roth's manual. In addition, the various strengthening exercises advocated can be used to advantage. It is interesting to note that the author has practically given up the use of plaster bandages, with the exception of absolute fixation, and that he uses instead various appliances, numerous cuts of which are scattered throughout the book. The Rollier system of heliotherapy is emphasized in bone tuberculosis. It will unquestionably find a ready sale, especially in England where there is a tendency to less specialization.

# ARCHIVES OF PEDIATRICS

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## ORIGINAL COMMUNICATIONS

### DOES A NEGATIVE SCHICK TEST INDICATE PRESENT AND FUTURE SECURITY FROM DIPHTHERIA?\*

By WILLIAM H. PARK, M.D.

New York.

This question can only be properly answered by considering not only whether the amount of antitoxin in the body which is sufficient to neutralize the toxin injected for the Schick test is sufficient to prevent diphtheria, but also whether a negative test indicates this; that is, whether there is apt to be error in the technique so that occasionally a negative outcome means a faulty injection or an improperly standardized toxin rather than a neutralization by antitoxin present in the body.

\*From the Bureau of Laboratories, Department of Health, City of New York. Read at a Symposium on Modern Methods for Prevention of Diphtheria, at the New York Academy of Medicine, May 23, 1921.

We have abundant evidence that a moderate amount of antitoxin in the body will prevent diphtheria. The cutting short of outbreaks in institutions by injecting the exposed inmates with 500 to 1000 units of antitoxin has occurred too frequently to leave any doubt of the preventive value of antitoxin. Its similar use in families has been successful in literally hundreds of thousands of cases. This immunity to diphtheria lasts for from 2 to 4 weeks and this period is very similar to that during which the injected individuals give a negative Schick test. Schick chose the amount of toxin used in the Schick with the hope of separating persons surely immune because of antitoxin normally present from those doubtfully immune or certainly not immune because of lack of such antitoxin. As there are all degrees in the amount of antitoxin possessed by different individuals from a total absence to a large excess beyond that needed for protection, it would be remarkable if Schick should have chanced on just the right amount for the test. It is evident that if he chose as the dose to be injected a larger amount of toxin than necessary, persons who were safe would be thought to be unsafe. If he chose too small a dose, the opposite result would follow. After an experience of 8 years, I and my associates have learned to put great faith in a negative Schick test, if we are certain that the toxin has been carefully standardized and that the intracutaneous injection has been properly made. We have put such trust in it that we have not immunized with antitoxin many children whom we know to have given a negative test in spite of the fact that they were exposed to infection with diphtheria bacilli. We have also withheld antitoxin from those who had suspicious throats and positive cultures because we considered a negative Schick test obtained by us to be sufficient security. We have never had any reason to feel that we have done wrong in such cases. These persons have recovered just as promptly as similar cases in which no diphtheria bacilli occurred. It must be recognized that while the absence of bacilli from a throat rules out the possibility of diphtheria, their presence simply makes such a diagnosis possible. If in a case of scarlet fever there had been given 50,000 units of antitoxin the day before the patient developed a croupous tonsillitis, we would not consider this to be a case of diphtheria because cultures showed diphtheria



bacilli. The positive culture reveals the danger of spreading infection; the clinical picture decides whether the case is one of diphtheria or not.

During the past 8 years we have carefully investigated every case of suspected diphtheria occurring in children or adults, who had given a negative Schick test. We have collected altogether 18 cases. Six of these we believe to be due to errors. On the other hand, we have met with 2 experiences in children and 2 in adults, all reported to have given negative Schick tests in which the development of exudative inflammation of the tonsils or of the tonsils and the lateral wall of the pharynx requires some other explanation. Some of these patients had been previously immunized because of a positive Schick test and others possessed antitoxin naturally.

The most striking and puzzling instance was in a Home for Orphans.<sup>1</sup> In one of the rooms containing small children who had all given negative Schick tests, 9 cases involving the tonsils alone or spreading from the tonsils to the side of the pharynx developed in the course of 8 days. The 7 most severe of these cases had diphtheria bacilli. The 2 of less severity, which were the final cases, showed no diphtheria bacilli. The test of some 50 healthy children, some within this room and others in other rooms showed the extraordinary fact that fully 50 per cent. of the children in all the rooms were, at the time, carriers of virulent bacilli. We have then the remarkable fact, that in other rooms no diphtheria ever developed, although so many of the children were carriers, while in the one room, 7 children developed a moderate diphtheria-like inflammation of the tonsils or of the tonsils and adjacent wall of the pharynx with bacilli and 2 others a follicular tonsillitis without diphtheria bacilli. All the cases made a good recovery, within 48 hours. The last 2 patients received no antitoxin and one of the others had definitely started to recover before the antitoxin was given. Antitoxin was given to all children in this ward but not to the children in the other rooms. No further cases developed in any part of the building.

The 2 suppositions which seem possible here are that some infection was prevalent in the ward which caused these cases of

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<sup>1</sup> Blauner: *Am. Jour. Dis. Child.*, May, 1921.

croupous tonsillitis and that the diphtheria bacilli were present without producing lesions. Because of being so prevalent in every part of the institution they would naturally be in these throats also. The other supposition is that while the children in this ward were ill with streptococcic tonsillitis, the diphtheria bacilli present in their throats grew in the exudate, produced endotoxins and exotoxins and these added slight superficial diphtheritic lesions to those caused by the streptococci. The amount of antitoxin naturally present would be conceived as too small in amount to prevent contact irritaion but as sufficient to prevent general poisoning. On either supposition, a case would recover as surely though possibly not as quickly without the injection of antitoxin, since there would be the small but sufficient amount of native antitoxin present in the blood and tissue fluids. An interesting fact developed when Williams and Mann tested the cultures from the 7 cases, as they were found to belong to at least 3 different agglutinative types. This is very strong evidence that the children did not contract diphtheria from each other or from any single source.

In another institution, St. John's Home in Brooklyn, a small outbreak of diphtheria occurred last winter among 1000 children, half of whom had been Schick tested and those giving positive reactions injected. Ten cases of suspected diphtheria were removed from this institution. Two of these were among children who had resisted the first series of 2 toxin-antitoxin injections but had shown a positive Schick test shortly before their infection. Five were new children who had recently arrived and had not been tested. Three others were children who had given a negative Schick test when tested by Dr. Schroeder or her assistants on their admission some 5 months before. One of these children had a brother older and one younger who gave positive Schick tests which suggested the possibility of an error in the test in this case. The negative results in the other patients may have been also due to errors, but there is, at present, no reason to suspect this. In this institution, therefore, the 3 cases occurring with a negative Schick test either would be explained on the same basis as the cases in the Home for Orphans or on the basis that an error had been made because of a faulty Schick test. As already stated, closely bound up with the answer to the question as to whether the minimum amount of antitoxin required

to prevent the Schick test is sufficient to prevent the development of diphtheria is the degree of certainty with which the general practitioner can assume that, as ordinarily carried out, a negative Schick test proves the presence of at least this minimum amount of antitoxin.

A Schick test requires the injection intracutaneously of 1/50 of a lethal dose for a 250 gram guinea pig in 1 c.c. or its equivalent. We recommend the equivalent of 1/40 M.L.D. in .2 c.c. because we find it a safer amount for the inexperienced to use. Reports to us some time ago of several series of diphtheria cases with no positive Schick reactions caused us to obtain outfits from various manufacturers. Zingher found in a considerable number of instances that the quantity of toxin in these outfits was much less than the required amount. The children tested with the designated amount of these solutions gave negative Schick reactions when, as shown by control injections, they should have given positive ones. More recent tests of outfits have given much more uniformly good results.

Not only must the toxin be accurately measured but the toxin must be delivered entirely intracutaneously. If the small white point does not appear at the point of injection, the Schick test cannot be relied upon. Careful investigation leads us to believe that about 2 per cent. of the persons giving negative Schick tests do so because of error in technique. Where great care has been taken to have the toxin strength correct and the injection given strictly intracutaneously we have not discovered any errors.

A negative Schick test gives almost as much assurance for future years as for the present. It is true that in the annual re-tests carried out in institutions by Dr. Zingher, Dr. Schroeder and others, we find that about 1.5 per cent. of the negatives of one year develop a positive reaction on the next annual test. This change is not much greater than we expect from the technique of the operation and from the difference in the toxin preparations. It is not unlikely, however, that the slight fluctuations in the amount of antitoxin which occur in every immune person may cause certain borderland cases to give at times a positive and at times a negative reaction. The tendency to continue to produce antitoxin in any case which has once developed it is extremely persistent.

*Summary and Conclusions.*—The Schick test can be compared with vaccination. A positive Schick reaction or a successful vaccination is a definite sign of a lack of immunity. A negative Schick or a negative result from vaccination is a strong suggestion of immunity but not an absolute assurance. In both cases this uncertainty is because of doubt as to the potency of the product and the accuracy of the technique. In either case, a repetition of the inoculation may be followed at times by a different result. Because of these facts it would be foolhardy to refuse to give a child antitoxin who had a history of a negative Schick test in the face of suspected diphtheria, just as it would be foolhardy to rely on a recent unsuccessful attempt at vaccination in the face of definite exposure to smallpox. Either improperly measured toxin or imperfect technique will probably prevent the development of the positive Schick reactions in susceptible persons. The failures are so few, however, that it is justifiable to consider that persons are in all probability immune who have a record of a carefully done negative Schick test.

It is very difficult to state to what slight degree, if any, a child or adult is liable to diphtheria who has enough antitoxin to prevent the development of a Schick reaction after a correct injection of the proper amount of toxin. The outbreak described by Dr. Blauner gives the nearest approach to proof that I have met with, for the statement that such persons may under unusual conditions develop a moderate infection. The fact that the cultures from the different cases showed different agglutinative types of virulent bacilli is proof that the cases did not come from a single source. The additional fact that more than 50 per cent. of the children in the other rooms were carriers of virulent diphtheria bacilli and yet developed no symptoms of diphtheria is strong evidence that the antitoxin in them was sufficient under ordinary conditions to protect them. The final fact that in the 2 last cases the diphtheria bacilli were not even present, shows that in this outbreak an infection other than diphtheria bacilli was capable of causing tonsillitis and was probably the primary cause. Considering all the facts together, it would seem to me that in spite of sufficient antitoxin to give a negative Schick test these children were, after infection with pyogenic cocci, really infected with the diphtheria bacilli that were previously in their

throats. I believe the antitoxin present in the cases would have prevented any appreciable development of diphtheria and that the cases would have recovered as certainly without the injection of additional antitoxin. It is not certain that the outbreak was not due to the pyogenic cocci alone.

Park and Zingher<sup>13</sup> consider the Schick test most reliable, when the toxin is of proper strength and the method of employing it is correct, in showing the presence or absence of antitoxic immunity to diphtheria. A negative reaction after the age of 2 or 3 years indicates that the individual is protected, probably indefinitely, against the disease. The great majority of positive reactions in children are true reactions and indicate an absence of antitoxin, and therefore, unless other antibodies are present, a susceptibility to diphtheria. They consider the test of great value in determining clinically the efficiency of the immunization of susceptible individuals, who have been injected with mixtures of diphtheria toxin and antitoxin. For this purpose only positive Schick cases should be chosen, and after the injections, they should be tested one, three, six and twelve months later to determine whether a sufficient amount of antitoxin had developed early or late to inhibit the Schick reaction, showing thereby the production of an active immunity to diphtheria. They use the Schick test to clear up the diagnosis of clinically doubtful cases of diphtheria. A negative reaction excludes diphtheria, while a positive Schick reaction leaves the diagnosis of diphtheria still a probability. The Schick reaction has added further proof to the clinical and experimental observations that very toxic cases of diphtheria do better when given an early intravenous injection of antitoxin than when it is administered in any other way. It reveals the fact that an intravenous injection of antitoxin is able to partly neutralize toxin 6 hours after its absorption by the tissues and thus gives us hope in some of the late cases of diphtheria. The results with the Schick test will serve as a reminder that after contact with the tissues for more than a few hours the effect of the toxin can no longer be prevented; that a day, and, in fact, hours of delay in the administration of a therapeutic dose of antitoxin may mean not only the absorption but the final binding of a fatal dose of diphtheria toxin.

13. Dept. of Health, City of N. Y., Reprint Series, No. 44, p. 3.

## DIPHTHERIA PREVENTIVE WORK IN THE PUBLIC SCHOOLS OF NEW YORK CITY.\*

By ABRAHAM ZINGHER, M.D., D.P.H.,

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Lecturer in Bacteriology, New York University and Bellevue Hospital  
Medical College.

1. *Introduction.* The very successful results obtained by us and by other workers in the active immunization of large numbers of children with diphtheria toxin-antitoxin has stimulated the Department of Health of New York City to begin an active campaign in diphtheria preventive work in the public and parochial schools of this city. Permission was obtained from the Department of Education to carry out the Schick test and the necessary active immunization in about 250 public schools. Beginning in 1916, a number of schools were Schick tested in the Boroughs of Manhattan, the Bronx and Brooklyn. During my absence in war service, the work was continued by Dr. Schroeder and other associates, but it remained limited in extent on account of lack of necessary personnel.

Through the coöperation of the Manhattan Chapter of the American Red Cross, Dr. Park obtained the financial aid necessary to start this work on a more extensive scale. A number of physicians, nurses and assistants were employed and divided into groups. In Manhattan and the Bronx, 2 groups have been working under my direction. Between the end of February, 1921, and the end of the school year, we have applied the Schick test in 44 of the larger schools in these 2 boroughs and have tested over 52,000 children. Those children who gave a positive or a positive combined reaction were injected with toxin-antitoxin. In the first 22 schools, the injected children were re-tested with the Schick test before the end of the school year, in order to determine which children had developed an active immunity against diphtheria. The following was the method followed in the schools.

2. *Introductory Procedure Before Schick Testing a School.* An interview was first obtained with the principal or assistant principal, the Schick test and toxin-antitoxin immunization were explained, and the coöperation of the school authorities was

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\*From the Bureau of Laboratories, Department of Health, City of New York.  
Read at a Symposium on Modern Methods for Prevention of Diphtheria, at the New York Academy of Medicine, May 23, 1921.

invited. Consent blanks and circulars of information to parents were left at the school to be distributed to all the children. Conference meetings were arranged at which the teachers were addressed by the principal or a physician, and their coöperation also requested. Each child was required to return the consent blank signed by the parent, with an affirmative or negative statement. The teachers later made out alphabetical lists of the names of those children whose parents had given their consent. Special sheets, called class sheets, were used for this purpose and also for recording subsequently the results of the Schick test and the injections of toxin-antitoxin.

Our work in the schools has been so greatly facilitated by the circular of information to parents and it has enabled us to obtain so many more consents that I think it will be of advantage to include its text in this communication.

### DIPHTHERIA PREVENTION

Department of Health

Department of Education

City of New York

To Parents:

Most parents expect that at some time or other their children may catch one or more of the common children's diseases, such as chicken-pox, measles, whooping cough, etc. But what parent does not fear two of these diseases: SCARLET FEVER AND DIPHTHERIA! How dangerous these truly are is shown not only by the many deaths they cause, but also by the serious after-effects they are known to leave—effects which may damage the body and ruin health for life.

#### DIPHTHERIA

It is of diphtheria we speak in particular. It is true that since the discovery of antitoxin much illness from this disease has been prevented and many lives have been spared. Yet the records of the Health Department of this city show what ravages this scourge of childhood still causes.

Here are some of the figures:

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#### Diphtheria: Incidence and Mortality, 1917-20.

Year	Cases	Deaths
1917	12,624	1,158
1918	11,455	1,245
1919	14,014	1,239
1920	14,166	1,045

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As recently as December 18, 1920, the Health Department called attention to a recent alarming increase in the number of cases of diphtheria.

For years and years physicians have been experimenting to discover some means of ridding the world of this disease. And why should they not hope to succeed? Two hundred years ago smallpox carried off hundreds of thousands of people yearly, and many of the persons one passed in the street were pockmarked for life. Today we know that vaccination has all but wiped out this dreadful disease, so that a few cases occurring in one year in a city as big as New York are a source of surprise and alarm.

#### A WONDERFUL DISCOVERY

It should then be a source of great joy to parents to learn that as the result of a recent discovery by Dr. Schick it is **now possible to say with certainty that diphtheria can be prevented and that not many years hence there will probably be as little diphtheria then as there is smallpox now.**

This discovery consists of two parts:

1. A method of finding out whether a child (or grown-up) is liable to get diphtheria or not.

2. A method of preventing those who are liable to diphtheria from ever catching this disease.

#### HOW IT WORKS

The first part of this discovery is called the Schick Test. It has been found that there are some children who will never get diphtheria, while others may. In other words, some are immune, while others are not. The purpose of the SCHICK TEST is to find out whether or not a child is immune to diphtheria, that is, whether he is likely to catch diphtheria or whether he is not likely to do so if exposed to the disease.

This is found out by giving the child a tiny injection in the skin of the arm and then watching whether a red spot is to be seen on the arm a few days afterwards. By the presence or absence of this spot, **the doctor can tell positively which children may get diphtheria and which never will.**

If the spot shows that a child may get diphtheria, then it is possible by means of three more injections of a different kind, given about a week apart, to "vaccinate" the child against diphtheria so that he will probably be protected against this disease for the rest of his life.

#### IT IS ABSOLUTELY SAFE

One of the fine things about this method of diphtheria vaccination is that **children are not made sick by it**, as sometimes happens after smallpox vaccination and often after typhoid vaccination. At the most they may suffer for a day or two from a painful spot in the arm. People who have heard how some of the men in the army suffered after some of the injections they received need have no fear; **no child has ever**



been known to have become ill as a result of the Schick injections.

#### PERSONAL EXPERIENCES

Having heard about this test many physicians, school principals and teachers came to the conclusion that if it is so valuable a protection against this serious disease, it was only their duty that their own children should receive the benefit of Dr. Schick's discoveries. They, therefore, had the injections given to them and they stated that they could vouch for the fact that their children did not as a rule feel the slightest illness or inconvenience as a result. They can now be sure that their children will never catch diphtheria from a school-mate or other persons.

#### FOR THE GOOD OF THE SCHOOL KIDDIES

Their next thought was that what was good for their own youngsters was equally good for the million boys and girls attending the schools in New York City. More especially did they think this when they considered how many of these children were actually falling victims to this disease. During the nine weeks from November 6th to December 31st 1920, many thousands of school children have been sent home because of sore throats which led the school nurse to suspect diphtheria. Of these 3,544 actually developed diphtheria and 211 died from the disease. At the same time many others had to be kept at home because of diphtheria in the family.

The school authorities have asked the Department of Health to have this test applied free of charge to all those children whose parents will give their consent. The school doctors are ready to extend this great benefit to all the children and will begin to make the test this month.

#### THIS IS YOUR OPPORTUNITY

So we take this occasion to recommend to you in the strongest terms that, when the nurse sends home a slip asking whether you will consent to have the SCHICK TEST performed, remember that no child will be given these valuable injections without consent of the parent; so **don't miss this opportunity**. If you are in doubt, ask your doctor, who, if you wish, is ready to perform the SCHICK TEST himself. The Department of Health gives a certificate of vaccination against diphtheria to every child receiving the test and injections. **Don't you want your children to hold this certificate? Don't you want to know as a positive fact that they have been protected for good against this dangerous sickness?**

And, by the way, children under five years catch diphtheria most easily. You can have the Schick Test and injections given to your children who do not attend school by applying at the nearest **Baby Health Station or Branch Office of the Bureau of Preventable Diseases.**



tinct, we added 25 per cent. excess of toxin and diluted 1.25 c.c. of toxin in 1,000 c.c. of saline. The dilution thus prepared represented in each 0.2 c.c. 1/40 M.L.D.

For the control test dilution we used instead of 1.25 c.c. 1.5 c.c. of toxin, heated to 75°C. for ten minutes, diluted with 1,000 c.c. of saline. The 20 per cent. excess of heated toxin in the control dilution as compared with the unheated toxin used in the Schick dilution was added for the purpose of allowing for any deterioration that might have taken place in the bacillus protein during the process of heating. By observing this precaution we found that children showing a negative pseudo-reaction would have an area of redness and later pigmentation equal in size and appearance on both forearms. In consequence there was less danger of mistaking a negative pseudo-reaction for a combined positive reaction.

The dilutions were freshly prepared each day for the day's work. No diluted toxin was kept over from one day to another.

The rule was adopted always to make the Schick test on the right forearm about 2 to 3 inches below the bend of the elbow and the control test on the left forearm in a corresponding location. One knew then exactly where to look for the reactions and could thus avoid confusion in the readings.

5. *Procedure on the Day of the Readings of the Schick Reaction and of the First Injection of Toxin-Antitoxin.* From 3 to 7 days after the Schick tests, the reactions were read. By reading the tests before three days have elapsed the interpretation of the reactions is not as accurate. Readings made on the third and fourth days showed somewhat better the fading pseudo-reactions, but a few doubtful reactions still remained, especially of the positive combined type. These were more accurately interpreted at the later readings. Very faintly positive Schick reactions, however, were likely to show no redness and only a slight brownish pigmentation when they were seen on the seventh day.

*The positive Schick reaction* represents the action of an irritant toxin upon tissue cells that are not protected by antitoxin. It indicates, therefore, an absence of immunity to diphtheria. A trace of redness appears slowly on the right forearm at the site of injection of the unheated toxin dilution in from 24 to 36 hours. The reaction reaches its height on the fourth day and gradually

disappears, leaving a definitely circumscribed scaling area of brownish pigmentation, which may persist for weeks and even for several months. At its height the positive reaction consists of a circumscribed area of redness and slight infiltration, which measures from 1 to 2 cm. in diameter. The degree of redness may vary to a great extent in different individuals, but always indicates, when typical, susceptibility to diphtheria. The injected area on the left forearm, where the control test was made, shows no redness.

*The negative Schick reaction* indicates that the individual is immune to diphtheria. The skin remains normal at the site of the Schick test and of the control test. The negative Schick reaction, however, can be accepted as indicating an immunity to diphtheria only if the test-toxin is of full strength, has been freshly diluted and the injection has been made *intradermally*.

*Negative pseudo reactions* appear at their greatest intensity at the end of 24 hours. By the fourth day, many of these reactions show only a moderate or a faint brownish pigmentation. With some the shade of redness persists. Others often show a bluish brown discoloration at the site of the test and of the control. Invariably, however, the reactions are *quite equal in appearance* on the two forearms. Slight differences between the test and control reaction may have no significance. Variations in the bacillus protein content of the test and control solutions or variation in the technique, where different individuals make the Schick test and the control test, may account for these slight differences on the 2 sides. *Marked* differences however, which are seen especially in the later reading of the Schick reactions and in which the area of redness with unheated toxin on the right forearm is always more pronounced, and has the other characteristic appearances of a positive reaction, should lead one to interpret the Schick reaction as *positive combined*. Children who have these positive combined reactions almost always show the more severe local and constitutional reactions after the injections of toxin-antitoxin.

Occasionally we see a small, sharply circumscribed bluish discoloration on one or both forearms. This is produced by slight hemorrhage into the skin at the time of the test and such reactions are generally seen in children with a hemorrhagic tendency.

The Schick reactions are read as (a) positive, (b) positive combined (c) negative, (d) negative pseudo. The first and second reactions indicate susceptibility to diphtheria and the children showing these reactions are given the toxin-antitoxin injections. The third and fourth reactions indicate immunity to diphtheria. The terms "positive combined" reaction is used to indicate more clearly the reaction previously known as "combined," and the term "negative pseudo-reaction," to indicate the reaction generally known as "pseudo-reaction." These new terms will help in representing more accurately to the reader the susceptibility or immunity respectively of the individual who has been Schick tested.

6. *Mixtures of Toxin-Antitoxin and Dosage.* In a previous communication<sup>3</sup> we have emphasized the importance of using for active immunization a mixture which was slightly *underneutralized* and yet *perfectly safe* for the human being. In some of our earliest work, we found that the best results were obtained with a mixture of such toxicity that 5.0 c.c., representing 5 times the amount injected into a person, would produce a pronounced local induration and late paralysis in the guinea-pig, but *not acute death of the animal*. Various mixtures were prepared by Dr. Banzhaf of the Research Laboratory and used in the different schools. In some of the schools the mixture used represented about 3 L plus doses of toxin to 3.5 units of antitoxin, in other schools about 5 L plus doses of toxin and a corresponding amount of antitoxin. The different mixtures have given us variable results, which will be stated further on.

The dose of toxin-antitoxin which was given in the schools during the last few months has been 1.5 c.c. instead of 1.0 c.c., the amount usually given. The number of doses with the larger amount was 2, however, instead of 3. The 2 injections were given to simplify the work in the schools if possible and to eliminate many children, found to be immune at the time of the Schick re-test, from getting the third injection of toxin-antitoxin. The results in the schools however point to the advisability of giving three doses rather than two.

The local and constitutional reactions after the injections of toxin-antitoxin varied considerably in different children. As a rule, those children who had given simple positive Schick reactions

showed very little local disturbance. On the other hand, children who had had positive combined reactions presented considerable local redness, swelling and tenderness of the arm at the site of injection and varying degrees of constitutional disturbance. Some of these children had temperatures varying from 100-103.5° which persisted for 1 to 3 days. In all children, however, the local and constitutional symptoms subsided without any after-effects. One of the interesting features was the practical absence of even a moderate local reaction among the young children of the Kindergarten and Grade 1A classes.

7. *The Second Injection of Toxin-Antitoxin.* One week later the positive and positive combined reactors received the second injection in the opposite arm. Occasionally a parent objected to the second injection owing to the painful reaction following the first one, but as a rule the 2 injections were given to most of the children. Children who were absent were seen a few days later and given the second injection.

8. *Record of Schick Reactions and Injections of Toxin-Antitoxin.* These records were entered on the children's class record cards and on the large class sheets on which the names of the tested children were arranged in alphabetical order. A strict checking-up system was used to avoid recording children, who had not received the test, as giving negative Schick reactions.

9. *Schick Re-test of Children Receiving Toxin-Antitoxin Injections.* A Schick re-test was made in 22 schools to note the efficiency of the toxin-antitoxin immunization. The late start of the work and the approaching vacations prompted us to re-test these schools at an earlier date than we should otherwise have done. These re-tests were made in most of the schools from 2 to 2½ months after the final injection of toxin-antitoxin. One school was re-tested 5 months after the injections of toxin-antitoxin.

10. *Certificates of Diphtheria Immunity.* Two forms of these certificates were issued to the children. One form, on light blue paper, was given to those who were found to be naturally immune by the original Schick test and the other form, on white paper, to those who had become immune after toxin-antitoxin injections, as was shown by the Schick re-test.

## DEPARTMENT OF HEALTH—CITY OF NEW YORK

## DIPHTHERIA PROTECTION CERTIFICATE

This is to certify that.....Age.....  
 residing at.....is naturally pro-  
 tected against DIPHTHERIA, as shown by the Schick Test per-  
 formed on.....192.... at.....  
 .....  
 Date..... Commissioner

## DEPARTMENT OF HEALTH—CITY OF NEW YORK

## DIPHTHERIA PROTECTION CERTIFICATE

This is to certify that.....Age.....  
 residing at.....has received pro-  
 tective injection against DIPHTHERIA and is protected against  
 the disease, as shown by the Schick Test performed on.....  
 .....192.... at.....  
 .....  
 Date..... Commissioner

11. *Public Schools in Which the Schick Test Was Carried Out.* Of the 44 schools in Manhattan and the Bronx in which the Schick test was done, 34 were tested by the group of which I had direct charge and the reactions were read by me. Ten schools were tested and read by the second group, of which Dr. O. I. Bloom had charge. The personal equation of many observers reading and interpreting the Schick reactions can therefore be eliminated and the results accepted as being quite uniform. Each child received not only the Schick test but also the control test with heated toxin. The reading of the tests was thus greatly facilitated and rendered quite accurate.

TABLE I.  
THE SCHICK TEST IN THE PUBLIC SCHOOLS OF MANHATTAN AND THE BRONX, NEW YORK CITY

P.S.	Location	Total Tested	Schick Pos.*	Schick Neg.*	Per Cent. Pos.	Pseudo	Per Cent. of Total of Neg.	Combined	Per Cent. of Total of Pos.
11-Bx.	169th St. and Ogden Ave.	297	200	97	67.0	25	8.4	25.7	3
77	1st Ave. & 85th St.	667	420	247	62.9	69	10.3	28.0	58
186	145th St. & Bdw.	824	460	364	55.8	102	12.3	28.0	6
46	St. Nich. Ave. and 156th St.	900	498	402	55.3	72	8.0	17.9	1
132	182nd St. and Wadsworth Ave.	708	356	352	50.2	79	11.1	22.4	4
89**	Lenox Ave. and 135th St.	856	411	445	47.9	34	3.9	7.6	6
68**	128th St. and Lenox Ave.	896	423	473	47.2	62	6.9	13.1	14
54	104th St. and Amsterdam Ave.	433	202	231	46.6	36	6.9	15.5	4
90	148th St. & 8th Ave.	443	510	953	46.5	89	9.3	17.4	13
169	169th St. and Audubon Ave.	825	379	446	45.9	200	24.2	44.8	28
5**	Edgecombe Ave. and 140th St.	1222	519	703	42.4	147	12.0	20.9	34
40-Bx.	Prospect Ave. and Jennings St.	1895	792	1103	41.8	330	17.4	30.0	57
157	St. Nich. Ave. and 126th St.	961	369	592	38.3	157	16.3	26.5	15
54-Bx.	Intervale Ave. and Freeman St.	1243	477	766	38.3	318	25.6	41.5	65
52-Bx.	Kelly St. and Ave. St. John	603	980	1583	38.0	75	4.8	7.6	9
43-Man.	129th St. and Amsterdam Ave.	763	285	478	37.6			NOT RECORDED	
84	50th St. & 10th Ave.	612	224	388	36.6	56	9.1	14.4	32
29	16 Albany St.	258	91	167	35.2	19	7.3	11.4	12
19	14th St. & 1st Ave.	1485	507	978	34.1	180	12.1	18.4	89
61	12th St. & Ave. B.	1387	481	906	34.7	109	7.8	12.0	57

\*Schick positive includes positive and combined reactions.

\*\*A large proportion of the children attending these schools are colored.

\*Schick negative includes negative and pseudo reactions.



TABLE I.—Continued.  
THE SCHICK TEST IN THE PUBLIC SCHOOLS OF MANHATTAN AND THE BRONX, NEW YORK CITY

P.S.	Location	Total Tested	Schick Pos.*	Schick Neg.*	Per Cent. Pos.	Pseudo	Per Cent. of Total	Pseudo of Neg.	Combined	Per Cent. of Total	Combined of Pos.
14	27th St. & 3d Ave.	1242	431	811	34.6	82	6.6	10.1	74	6.0	17.1
96	Ave. A and 81st St.	1065	346	719	32.5	213	20.0	29.6	47	4.4	13.6
101	111th St. and Lex. Ave.	968	285	683	29.7			NOT RECORDED			
15	4th St. & Ave. D.	1192	346	846	29.0	108	9.0	12.7	19	1.7	5.4
188G	Houston St. and Lewis St.	1216	347	869	28.5	307	25.2	35.3	42	3.4	12.1
158	77th St. & Ave. A.	953	263	690	27.5	155	16.2	22.4	20	2.0	7.6
103	119th St. and Madison Ave.	1363	387	976	28.3	169	12.3	17.3	13	0.8	3.3
43-Bx.	135th St. and Brown Place	1966	521	1445	26.5	344	17.5	23.8	28	1.4	5.3
39G.	125th St. & 2d Ave.	931	243	688	26.1	162	17.4	25.0	23	2.4	9.4
57	115th St. & 3d Ave.	1368	355	1013	25.9			NOT RECORDED			
85	1st Ave. & 115th St.	971	252	719	25.9	37	3.8	5.1	29	3.0	11.5
42-Bx.	Washington Ave. & Claremont Pk.	1284	309	975	24.1	239	18.6	24.5	27	2.1	8.7
188B.	Houston and Lewis Streets.	1460	325	1135	22.3	228	15.6	20.0	29	2.0	9.0
171	103rd St. and Madison Ave.	1866	414	1452	22.2	415	22.2	28.5	64	3.4	15.4
78	119th St. and Pleasant Ave.	1987	440	1547	22.1	296	14.8	19.1	40	2.0	9.0
20	Rivington and Eldridge Sts.	1540	321	1219	20.8	252	16.3	20.6	19	1.2	5.9
159	119th St. & 3d Ave.	1301	256	1045	19.6	313	24.0	30.0	47	3.0	18.3
62	Hester and Essex Sts.	1261	246	1015	19.5	176	13.9	17.3	25	2.0	10.0
64	9th St. & Ave. B.	1035	197	838	19.0	175	17.0	20.9	16	1.5	8.0
39B.	126th St. & 2d Ave.	847	157	690	18.5	139	16.4	20.1	27	3.1	17.2
102	113th St. & 2d Ave.	1687	296	1391	17.5	105	6.2	7.5	36	2.1	12.1
168	104th St. & 2d Ave.	1569	278	1291	17.7	335	21.3	26.0	27	1.7	10.0
172	108th St. & 2d Ave.	1540	253	1287	16.4	101	6.5	7.8	17	1.1	6.7
83	109th St. & 3d Ave.	2349	320	2029	13.6	552	23.4	27.2	67	2.8	2.0

\*Schick positive includes positive and combined reactions.

\*Schick negative includes negative and pseudo reactions.

Table I shows the schools in which the Schick test was performed and gives in tabulated form the total number of positive, negative, negative pseudo and positive combined reactions and the percentages of these reactions. The schools are arranged in the order in which the susceptible children were found, those having the largest number being placed first in the table.

It is interesting in connection with this table to analyze the density of the population of the different neighborhoods, in which the schools are located. It will also be of interest to know the nationality and the race of the children attending the various schools.

(a) P. S. 11, Bronx, showing the highest proportion of positive Schick reactions, is located in an old established and rather sparsely settled neighborhood. Most of the children attending this school are of American parentage.

(b) P. S. 77, is also located in a fairly old established but more densely populated neighborhood. Many of the children attending this school are of German extraction.

(c) P. S. 186, 46, 132, 169, 157 and 43, Manhattan, are located in the upper West side of the City above 125th Street, in a section including Washington Heights. The children attending most of these schools come from a fairly well to do part of the population. The families live as a rule in large and expensive apartment houses, and the children are kept fairly segregated. P. S. 54 is attended by a similar class of children from the Broadway and West End Avenue section of the City.

(d) P. S. 89, 68 and 5, have a large proportion of *colored* children. In P. S. 89, more than 95 per cent. of the children are colored.

(e) P. S. 54, Bronx, and 40, Bronx, are attended by children of the middle class of our population. The neighborhoods in which these schools are located are well populated, but not densely crowded. These schools are attended to a large extent by children of the Hebrew race.

The following schools are located in congested neighborhoods:

(f) P. S. 90, 84, and 29 are on the West side of the City. The children attending these schools are mostly of American parentage. Many of the children are of Irish extraction.

(g) P. S. 61, 101, 15, 188 G., 188 B., 103, 57 and 64 are

largely attended by children of the Hebrew race. The schools are located in densely congested neighborhoods of the lower and upper East side of the City.

(h) P. S. 158. The children attending this school are largely of Bohemian and Italian extraction.

(i) P. S. 19, 96, 78, 39 B., 39 G., 102, 168 and 172 show a large attendance of children of Italian extraction.

#### DISCUSSION.

I. *Results of Schick Test.* The results with the Schick test in the 44 schools given in Table I are interesting and significant. They show that:

1. Children from the homes of the more well to do have a much higher percentage of positive Schick reactions than those from the homes of the poorer classes of the population, who live in closely crowded neighborhoods. The table shows that in some schools as many as 67.0 per cent. of the children were found to give a positive reaction. The percentage diminishes as we follow the schools down on the table until we reach schools located in the densely congested sections of the East Side, where not more than 16 to 20 per cent. gave positive reactions.

2. *Contact immunity* seems to be an important element in the establishment of the so-called "natural immunity." Repeated exposure to the diphtheria bacillus in the congested districts causes not only actual clinical cases of diphtheria to develop but also produces mild infections of the mucous membranes which are not recognized as diphtheria, but which may lead to the gradual development of an antitoxic immunity. This theory has received striking support from the results of the Schick testing of two private schools and one rural school\*. At the Lawrenceville School near Trenton, N. J., 79 per cent. of boys, varying in age from 12 to 21 years, gave positive reactions; at the George School, Georgetown, Pa., 75 per cent. of the children gave positive reactions. In a rural school at Shilo, Cumberland Co., N. J., Dr. Knight of the New Jersey State Department of Health found that 85 per cent. of the children gave positive Schick reactions. These are striking figures and indicate that segregation of the children, either among the well to do or in rural and sparsely set-

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\*I am indebted to Mr. Bowen, Secretary of the New Jersey State Department of Health for the results of the Schick test at the Lawrenceville School, and to Dr. David F. Weeks, Superintendent of the State Hospital for Epileptics at Skillman, N. J., for the results at George School.

tled sections, plays an important factor in retarding the development of natural immunity to diphtheria.

3. A study of the racial types, as represented by the child population of the different schools, gives other interesting data and shows that the *racial factor* must also be considered as one of the influences in the development of natural immunity.

(a) Children of the colored race, living often in congested neighborhoods, showed in spite of the crowded conditions a high proportion of positive Schick reactions. I had had occasion to note this racial peculiarity 7 years ago at the Howard Colored Orphan Asylum at Kings Park, L. I., and a year later at the Colored Orphan Asylum at Riverdale-on-the-Hudson.

(b) Children of Italian extraction, living in the crowded East Harlem section of New York City, gave the lowest percentage of positive reactions.

(c) Children of Bohemian and Irish extraction gave about one-third positive Schick reactions.

(d) Children of Hebrew parents varied considerably in the percentage of positive Schick reactions. Those living in the congested sections of the City showed a low percentage, while those living in the upper West Side section of the City were among those who gave the highest percentage of positive reactions.

4. The *family factor* is also of importance in the development of natural immunity. This was brought out in some of our<sup>4</sup> earliest observations on the results of the Schick test in groups of children belonging to the same family. We found that there was a marked tendency for all the children of the same family to show a similar Schick reaction, whether it was positive or negative. Where variations were found in the reaction, the younger children as a rule gave the positive, the older children, the negative Schick reactions. The reverse condition, where older children gave a positive and younger children a negative reaction was very rare, except in families with young infants, who often gave a temporary negative reaction due to maternal immunity. These observations were repeatedly confirmed in our more recent work in the public schools. While as a rule the living conditions and consequent exposure to diphtheria infection are very similar for all the children of the same family, yet we have seen that different families living under closely parallel conditions often show entirely different Schick reactions. With re-

gard to antitoxin production there is probably an hereditary tendency on the part of the children of one family to respond either readily or slowly and poorly to repeated mild infections with the diphtheria bacillus. This organism is as a rule universally prevalent in larger communities. For example, in New York City we always have on an average about 4 to 5 per cent. of bacillus carriers.

5. Natural antitoxic immunity in human beings therefore can be interpreted as due to a combination of factors in which *contact immunization* seems to play the most important part. The *racial* and *hereditary family factors* however, must also be considered as important elements in the development of such natural immunity.

6. The table shows a fairly high proportion of negative pseudo-reactions among children of school age. It is interesting to note that there is a much higher proportion of negative pseudo-reactors among the immunes than there is of positive combined reactors among the non-immunes. We can therefore assume that repeated exposures to infection with the diphtheria bacillus brings about not only an antitoxic immunity, but also a hypersensitiveness of certain predisposed individuals to the diphtheria bacillus protein. The development of this hypersensitiveness renders the cells of the epidermis of the pseudo-reactor anaphylactic to the autolyzed protein of the diphtheria bacillus which is present in the test solution of toxin. The infrequent exposure of positive reactors to infection with the diphtheria bacillus accounts for the smaller number of positive combined reactions among them.

Among the colored children we noted a relatively low percentage of pseudo-reactions. There seems to be a racial tendency in these children to respond poorly to the antigenic action not only of the diphtheria toxin, but also of the bacillus protein.

II. *Results with Toxin-Antitoxin Immunization.* Table II shows results in a few of the schools in which the children receiving the toxin-antitoxin injections were re-tested. P. S. 90 was the only school in which the children had received *three* injections of toxin-antitoxin and the re-test was made after *five months*. In this school 87.5 per cent. of the injected children were found to have become immune as shown by a negative Schick

TABLE II.  
RESULTS OF RE-TESTS AFTER DIPHTHERIA TOXIN-ANTITOXIN IMMUNIZATION IN  
NEW YORK CITY PUBLIC SCHOOLS.

P.S.	Location	Time Since Injection	Preparation Used	Doses Given	Amount	Total			Per Cent. Neg.
						Children Retested	Schick Pos.	Schick Neg.	
90	148th St. & 8th Avenue	5 mo.	No. 24	3	1 c.c.	160	20	148	87.5
101	111th St. & Lexington Av.	2.5 mo.	No. 23	2	1.5c.c.	152	31	121	76.1
57	115th St. & 3rd Avenue	2.5 mo.	No. 23	2	1.5c.c.	254	90	164	64.5
168	105th St. & 2nd Ave.	2 mo.	No. 35	2	1.5c.c.	213	98	115	52.7
43	129th St. & Amsterdam Avenue.	2.5 mo.	No. 23	2	1.5c.c.	183	103	80	43.8
Man. 43	135th St. & Brown Pl.	2.5 mo.	No. 35	2	1.5c.c.	397	257	140	35.2
Bx. 186	145th St. & Broadway	2.0 mo.	No. 23	2	1.5c.c.	291	206	85	29.9
132	182nd St. & Wadsworth Avenue.	2.0 mo.	No. 23	2	1.5c.c.	213	154	59	27.7
46	St. Nicholas Avenue & 157th Street.	2.0 mo.	No. 35	2	1.5c.c.	302	226	76	25.1
157	127th Street & St. Nicholas Avenue.	2.0 mo.	No. 35	2	1.5c.c.	253	199	54	21.3

reaction. The other injected children gave reactions that were still positive, but were very much fainter than the original reactions. A fourth injection of toxin-antitoxin was given to these children.

In the other re-tested schools, only 2 injections of toxin-antitoxin had been given from two to two and a half months previously. Two of these schools (P. S. 101 and 57), located in the more densely crowded sections of the City, showed 76.1 and 64.5 per cent. positive Schick reactions respectively. These results compare favorably with those noted in the other schools given in the table, in three of which we had used the same preparation of toxin-antitoxin (P. S. 43 Manhattan; 186 and 132). In the last 2 schools, however, the Schick re-tests were made after 2 months. In the remaining 2 schools noted in the table (P. S. 43 Bronx, and 46), a different mixture of toxin-antitoxin was used, but the results were about the same.

One feature of the Schick re-tests was noticeable. Most of the children who continued to give a positive reaction showed a much fainter area of redness than in the original test. In many instances the brownish pigmentation of the original positive reaction was still visible and was even at this time much larger in diameter than the area of redness of the re-test. The fainter reactions in the re-tests stood out also in striking contrast to the strongly positive reactions of children who had received the Schick test for the first time.

Children who showed a positive reaction, even though it was very small in size and faint in appearance, received one or two additional injections of toxin-antitoxin. Schick re-tests will be made again next fall and we expect from the results of our previous experience that most of these children will then give a negative reaction.

III. *Age Incidence in Relation to Active Immunization Against Diphtheria.* The child population can be divided for purposes of active immunization into five distinct groups.

TABLE III.

*Importance of Age in Active Immunization With Toxin-Antitoxin.*A. *Infants Under Six Months.*

- |                         |  |
|-------------------------|--|
| (a) Under three months  | { Children mostly immune (maternal). Do not develop an active immunity after toxin-antitoxin.  |
| (b) Three to six months | { Generally found to be immune (maternal). Toxin-antitoxin may be used, but it is not as effective as when used in the following age-group. A negative Schick test cannot be depended upon to indicate a permanent immunity. |

B. *Pre-School Age.*

- |                             |   |
|-----------------------------|---|
| (a) Six months to two years | { Schick test can be omitted in this group, as the proportion of positive reactors is very high. A negative Schick reaction cannot be depended upon to indicate a permanent immunity. Strongly advisable to give toxin-antitoxin <i>to all these children</i> . |
| (b) Two to five years       | { Schick test may be used first. Positive reactions very high. Procedure can be greatly simplified by omitting Schick test and injecting <i>all these children with toxin-antitoxin</i> .   |

C. *Public School Age.*

- |                          |   |
|--------------------------|---|
| (a) Five to six years    | { Incoming classes (Kindergarten and 1A). Schick test may be used first. Positive reactions over 65 per cent. <i>Strongly advisable to inject all these children with toxin-antitoxin</i> .   |
| (b) Six to fifteen years | { Schick test and control test <i>should</i> be used <i>first</i> . Many negative pseudo-reactions must be excluded. Toxin-antitoxin for Schick positive and positive combined reactors only. |



D. *High School Age.*

- (a) Fifteen to nineteen years
- { Schick test and control test should be used  
first. Many negative pseudo-reactions  
must be excluded. Toxin-antitoxin for  
Schick positive and positive combined re-  
actors only.

E. *Adolescents and Adults.*

- (a) Nineteen years up
- { Schick test and control test should be used  
first. Many negative pseudo-reactions  
must be excluded. Toxin-antitoxin for  
Schick positive and positive combined re-  
actors only.

Table III gives in a condensed form the indications for the Schick test and toxin-antitoxin immunization.

A. Infants under six months are protected temporarily in fully 85 to 90 per cent. by an inherited maternal antitoxic immunity against diphtheria. The inherited antitoxin not only protects these children, but it also interferes with the development of an active immunity, when they are injected with toxin-antitoxin.<sup>5</sup> It is, therefore, important to wait until most of this inherited antitoxin has been eliminated before attempting to inject the children with the toxin-antitoxin.

B. Probably the most important period of life in which the toxin-antitoxin should be used is from *six months to two years*.<sup>6</sup> A negative Schick reaction in this group cannot be entirely depended upon, as the reaction later changes in many of these infants from negative to positive (loss of maternal immunity). It is therefore *strongly advisable* to omit the Schick test and inject *all children* in this group with the 3 doses of toxin-antitoxin.

To make certain that we reach most of the susceptible children, it is just as strongly advisable to inject also *all children from 2 to 5 years of age*. The negative Schick reaction in this age group is probably a permanent index of natural immunity. The proportion of susceptible children, however, is very high and the *omission* of the Schick test would simplify this important immunizing procedure for many physicians and thereby make it more certain that a greater number of them would

recommend and use it. The simple subcutaneous injection of 3 doses of toxin-antitoxin would appeal to many physicians who are not thoroughly acquainted with the technique or the interpretation of the Schick test.

The high proportion of positive Schick reactions in children from 6 months to 5 years of age and the corresponding high morbidity and mortality from diphtheria in this group (80-85 per cent. of all diphtheria cases) are strong indications for the active immunization of *all children under five years of age*. The injections of toxin-antitoxin produce very little pain and discomfort in these young children because only very few are hypersensitive to the bacillus protein as shown by the small percentage of negative pseudo-reactions among them. The statement may even be definitely made that the younger the child the more tolerant it is to the injections of toxin-antitoxin.

At all ages it should be remembered that no individual can be pronounced immune to diphtheria until he has been proven to be so by the Schick test. Until this is done it is always a question in each case whether the particular child has responded to the toxin-antitoxin stimulation. For this reason the Schick test must never be omitted as a final part of the procedure of active immunization against diphtheria.

The facts indicate that the solution of the diphtheria problem depends upon just such a general active immunization of all children of pre-school age. Compulsory immunization would be a great forward step in this direction, if public opinion could be converted by educational propaganda to the advisability of such a step.

C. The children of school age can be divided into 2 groups: (a) the entering classes and (b) the higher grades.

(a) The entering classes comprise in the educational system of New York City the Kindergarten and 1-A Grades. This group is of special interest to the health official, as it is through these classes that he is enabled for the first time to exercise his influence more directly upon the young children of the community. For the reasons stated above and until we shall have established the principle of actively immunizing against diphtheria all children of pre-school age, it will be advisable to inject *all children of the incoming classes* in our public schools with toxin-

antitoxin. The omission of the Schick test will simplify the work for the school physician or health officer, who will then be more apt to recommend and use the toxin-antitoxin. If this procedure is followed, there will be created within a few years a diphtheria immune school population. Until we can do this as a routine, however, we shall have to take into account, for the present at least, the many susceptible children who are now in the higher grades.

(b) In the second group, Grade 1-B and upward, the Schick test and control test should be used before immunization for the following two reasons: 1. In many schools the number of positive Schick reactions may not be more than 16-25 per cent. In such schools by a preliminary Schick test many children can be saved from getting unnecessary injections of toxin-antitoxin. 2. From 10-25 per cent. of children of school age give a negative pseudo-reaction (Table I). These children are not only immune to diphtheria, but they are the very ones who would have *severe local and constitutional reactions* after injections of toxin-antitoxin.

School children who give a positive or positive combined reaction should receive the three injections of toxin-antitoxin. Children who have a positive combined reaction will generally show moderate or fairly severe local and constitutional symptoms. Most of these symptoms subside, however, after two to three days. In over 50,000 injections of toxin-antitoxin, which we have given during the past 4 months, we have not seen a single serious result or a single infection. This statement must be emphasized as the swelling of the arm at the site of injection leads some of the parents to think that the child has "blood poisoning."

D. and E. Children over fifteen years of age and adults should always have the Schick test and control test applied before immunization to determine their susceptibility to diphtheria. It is in these individuals that we find the more marked forms of negative pseudo-reaction which should be identified as such and not mistaken for positive or positive combined reactions. It may be left optional with the adult individual who has a positive combined reaction whether or not he should receive the toxin-antitoxin.

#### SUMMARY AND CONCLUSIONS.

1. The Schick test and the control test have been applied during the past 4 months to more than 52,000 school children

in 44 public schools in the Boroughs of Manhattan and Bronx. Those who gave a positive or a positive combined reaction were injected with toxin-antitoxin.

2. The results of the Schick test in these schools indicate that the so-called "natural immunity" depends to a large extent upon *contact immunity* developing after repeated exposures and mild infections with the diphtheria bacillus.

3. The children of the more well to do classes of our population show a much higher proportion of positive Schick reactions than do the children of the poorer classes. Relative segregation of the first, crowding and close contact of the second, probably account for these results.

4. The factors of race and hereditary family tendency also seem to influence considerably the development of natural immunity to diphtheria.

5. Negative pseudo-reactions were found in some schools in fully 20-25 per cent. of the children. These figures indicate that it is strongly advisable always to use the control test along with the Schick test in children over 5 years of age so as to identify accurately the children who show a negative pseudo-reaction and thus avoid giving them the injections of toxin-antitoxin.

6. The results of the Schick re-tests, which were made in the above schools after two to five months, indicate that it is better to wait at least six months or preferably longer before testing for the development of an active immunity after toxin-antitoxin inoculation.

7. Two injections of toxin-antitoxin, even of a larger amount, do not give as good results as three injections of a smaller amount. The mixture should be *underneutralized* and yet *perfectly safe* for the human being.

8. Children under 6 months should not be injected with toxin-antitoxin. They are generally immune (85-90 per cent.) and do not respond to these injections, as is shown when they are Schick tested later.

9. *All children from 6 months to 5 years should be injected with toxin-antitoxin.* The omission of the Schick test is not of much consequence in this age group, as most of the children give a positive reaction. A majority of these children can be reached

in the homes, in milk stations, day nurseries, children's dispensaries, infant and orphan asylums, etc.

10. To place the diphtheria preventive work in the public schools of a large city on a practical basis, it is advisable for the present at least to simplify it for the school physician by omitting the preliminary Schick test in the younger children and by immunizing *all children of the incoming classes* with toxin-antitoxin.

11. No child should be pronounced, however, immune to diphtheria until it gives a negative Schick reaction. The test should not be made until at least 6 months have elapsed after the injections of toxin-antitoxin.

12. School children in the grades above the incoming classes should have the Schick test and control test made before they are injected with toxin-antitoxin.

13. Only reliable outfits for the Schick test and carefully prepared mixtures of toxin-antitoxin are of value in such preventive diphtheria work.

The Schick work in the schools was carried out under the direction of Dr. William H. Park and in coöperation with Drs. J. S. Baker, Jacob Sobel and J. Blumenthal of the Bureau of Child Hygiene and Dr. Louis I. Harris of the Bureau of Preventable Diseases of the Department of Health. Dr. I. H. Goldberger of the Bureau of Educational Hygiene of the Department of Education was largely instrumental in obtaining permission for us to do the work in the different schools. The financial support given us by the Manhattan Chapter of the American Red Cross and the interest of Mr. George R. Bedinger, who is in charge of its Health Service Department are gratefully acknowledged in enabling us to carry out this work on such an extensive scale. I also wish to acknowledge the valuable assistance of my co-workers, Drs. O. I. Bloom, M. Klorman, M. J. Radin and H. L. Flowers and the Misses L. Alper, E. van Doenhoff and E. Yarmulinsky.

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## THE SCHICK TEST AND ACTIVE IMMUNIZATION WITH TOXIN-ANTITOXIN IN PRIVATE PRACTICE.\*

By DEVER S. BYARD, M.D.

New York.

For several years Dr. Park and Dr. Zingher have been urging methods and demonstrating means for the control of diphtheria. The community program which they and their associates have initiated has passed all condition of experiment. The agents recommended, the Schick test for determining immunity, and the toxin-antitoxin inoculation to confer immunity, are available to us; their use is simple, precise; the result in prevention, dependable.

In institutions, public schools, day nurseries, and milk stations, thousands of children have received the beneficent operation of these methods. The Research Laboratory, by suggestion and appeal, and the Department of Health, through its proper agencies, have given this prevention program a splendid public functioning. Through such efforts, in a definite, large way, a considerable immune population is being established. But of the million and a quarter children in this city of an age group susceptible to diphtheria, there are approximately 500,000 who are some or all time private patients. These do not come within such organized preventive effort. To make them safe subjects in the community, to secure for them an immunity to diphtheria identical with that conferred through public agencies, is the outstanding opportunity and responsibility of the private physician. Protective inoculation against diphtheria must have, soon will have, its accepted household place with the present required vaccination against smallpox.

During the 2½ years ending March 31, 1921, of all cases of diphtheria in this city, an average of over 78.2 per cent. have occurred in and were treated in private homes. In 1920, there were 10,386 cases thus treated. Such statistics challenge the initiative and efficiency of medical performance in these proved, specific, preventive measures. They emphasize the outstanding importance of private physicians—pediatrists and practitioners—in all matters looking to diphtheria control in our community.

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\*Read at a Symposium on Modern Methods for Prevention of Diphtheria, at the New York Academy of Medicine, May 23, 1921.

This following, brief, clinical summary expresses the response of average parents and guardians to a new program of prevention affirmed to be expedient and effective. It shows the reactions to the Schick and toxin-antitoxin regimen of average infants and children. The records cover the period from April, 1918, through December, 1920.

*Families.*

192 families are included in this survey.

29 or slightly over 15 per cent. refused coöperation, both in Schick test and toxin-antitoxin prevention.

163 or 85 per cent. accepted the program in whole or part.

82 accepted a preliminary Schick.

81 refused preliminary Schick for babies under 20 months.

71 allowed a second re-test January to May, 1921, of children inoculated in 1918 and 1919.

7 refused request for this later observation.

All families willingly granted a single 8 months' post-inoculation test to determine conferred immunity.

8 family heads were physicians.

7 family heads professed Christian Science belief.

*Subjects.*

338 children are included in these records:

166, under 1 year (8 under 6 months).

71, one to two years.

58, two to five years.

43, six to nine years.

*Susceptibility.*

5 under one year.

21 naturally immune. 9 one to two years.

7 two to five years.

255 susceptibles.

185 Schick positive by test.

70 under 20 months, presumably susceptible each having brother or sister in the above Schick positive group.

62 doubtful not tested.

In homes having infants and older children, with parental reluctance to preliminary Schick test upon infants, the "controlled" Schick reaction of an older

child probably may be accepted for the "familial" state of susceptibility.

*Total Inoculation—TAT. 317.*

- 317: 161, under one year.  
       62, one to two years.  
       51, two to five years.  
       43, six to nine years.

*Dosage.*

- 249 children, April, 1918, to September, 1919, received doses of 1 c.c. TAT for those 20 pounds weight, or 1 year old;  $\frac{1}{2}$  c.c. for those smaller or younger.  
 68 children subsequently done in 1919 and 1920 all received 1 c.c. TAT except especially young infants or those under 15 pounds. These received  $\frac{3}{4}$  c.c.  
 10 cases each received 2 doses 1 c.c. TAT. One only of these failed to be immunized. C. B., 22 months old infant, TAT February, 1919; re-Schicked October, 1919; 2 re-inoculations 1 c.c. each, November 1919; was negative February, 1921.

While 3 doses seem desirable it is likely that for many subjects 2 standard 1 c.c. doses TAT are sufficient.

- 11 cases of positive or doubtful susceptibility in 8 months post-inoculation re-test received 2 doses 1 c.c. each TAT q. v.

*Reaction.*

- 7 babies, 9 months to 2 years, and 18 older subjects showed slight to considerable local swelling at point of inoculation.  
 8 children, under  $2\frac{1}{2}$  years, had annoying degrees of general urticaria continuing 1 to 3 days.  
 8 children (2 under one year; 2, one to two years; 4, three, five, eight, and ten years) giving both pseudo and positive Schick reaction had marked erythematous rash, lasting 1 to 2 days.  
 1 boy, 3 years old, with a positive and pseudo-Schick reaction, 8 hours after first inoculation 1 c.c. TAT had for 15 subsequent hours impressive languor, slow, irregular pulse, general pallor, subnormal temperature, repeated nausea. Second inoculation  $\frac{1}{2}$  c.c., 10 days later, similar symptoms, less degree, no nausea. Third dose  $\frac{1}{2}$  c.c., no symptoms.



*Temperature.*

Averaging 101° during 24 hours succeeding inoculation there was present in 5 children under two and 14 older subjects. 6 subjects, 3 to 5 years old, for 12 to 36 hours after first and second inoculation had temperatures varying from 101° to 104°. Generally speaking, subjects under 1½ years had scarcely noticeable local or general reactions.

287 subjects were noted as showing no observable reactions or symptoms.

*Immunity.*

15 definite and prolonged exposures to diphtheria occurred in 7 children under 2 years, 6 in those between 3 and 5 years, and 2 in subjects less than 7 years. None of the 15 gave evidence of diphtheria, although cultures several times made from noses and throats of 13 of these showed undoubted Klebs-Loeffler bacilli.

*Conferred Immunity by Test.*

Of 317 children receiving TAT, 286 were Schick tested at a date averaging 7 months after inoculation.

143, under 1 year when done, showed 5 positive, 2 very doubtful.

64, 1 to 2 years when done, showed 2 positive, 2 doubtful.

43, 2 to 5 years when done, showed all immune.

36, 5 to 9 years when done, showed all immune.

7, or 2.4 per cent. of the 286 tested, after 8 months, were susceptible.

4 of the 286 tested were regarded as slightly or doubtfully positive.

*Conferred Immunity by Later Test.*

170 children who received TAT in 1918 or 1919 were given a re-Schick in the period from January to May, 1921, at a post-inoculation interval not less than 15 months. This group included the 11 children above noted (that is 7 positive and 4 doubtful in the 8 month post-inoculation Schick), who received a second 2 dose 1 c.c. TAT injection.

13 of 1918 and 1919 untested since inoculation.

136 shown in 8 month post TAT test to be immune.

- 103, under one year
- 16, one to two years.
- 34, two to five years.
- 17, five to seven years.
- 165 remained immune.
- 3 remained susceptible.
- 3 from the 13 untested since TAT 1918 and 1919.
- 2 doubtful.

1 negative at 8 months post TAT test.

1 under 8 months when (inoculated) done.

In this time, averaging 18 months after inoculation, 1.8 per cent. failed of immunity. 1.2 per cent. more were doubtfully protected. It is interesting to note that 3 of these positive in this testing were of the 31 children of 1918 and 1919 not having an 8 months post TAT Schick and that these 3 are of the same family. All of the 11 not immune at the 8 month interval of re-test and who received a second 2 dose inoculation were in this test immune.

Of the 299 children tested, accepting the combined results of the early and later re-Schicking, five or 1.7 per cent. failed of immunity.

In the Schick testing and re-testing during the past 1½ years for all older subjects a control reaction has been observed. This is important as a gauge of the degree of the frequently observed reactions due to protein.

No presumption of statistical value is held for these purely, clinical observations. They do, however, attest large parental co-operation and the summaries closely approach the expectation of result of Schick test and TAT use, which the precise and extensive work of Dr. Park and Dr. Zingher has formulated. They particularly instance the high susceptibility to diphtheria of groups of children in private families having average community contacts and exposure. The records of these children, over 50 per cent. of whom were under one year of age, confirm the safety and expediency of the preventive measure.

The high degree of conferred immunity warrants an urged, aggressive program. Average conservative families will view as intelligent procedure the preliminary Schick, the post-inoculation test, re-test, and, if needed, further inoculation. The responsibility is ours. The public, sufficiently advised, will prudently coöperate in this undertaking which so importantly concerns it.

## PREPARATION OF MIXTURE OF DIPHTHERIA TOXIN-ANTITOXIN\*

By EDWIN J. BANZHAF, M.D., and CHARLES K. GREENWALD, M.D.

New York.

In preparing the toxin-antitoxin mixture used for active immunization against diphtheria, it is essential to have diphtheria toxin of very high potency. The toxin we employ has a minimal fatal dose† of 0.002 c.c. to 0.0007 c.c. The advantage of using such highly potent toxins is that they may be diluted with salt solution to the toxin strength actually required, lessening in this way the concentration of other substances (meat extractives, peptone, bacillary substance, etc.), which give rise to local and constitutional reactions.

The most important factor in these reactions is the bacillary substance. The presence of this substance is due to the autolysis of the various bacteria which develop during the preliminary process of fermenting the meat infusion, as well as autolysis of the diphtheria bacillus which is grown on the finished medium for the production of toxin. Recently, at Dr. Park's suggestion, the chopped meat is boiled with the required amount of water, thereby producing a sterile infusion. It is then inoculated with *B. coli*, which produces the necessary fermentation. By this procedure the autolytic products are reduced to only those produced in the growth of *B. coli* and of *B. diphtheriae*.

The bacillary substance cannot be eliminated by any method at present available. At best, we can only minimize the reactions in those who are hypersensitive to these substances, by using only highly potent toxins, which, as stated above, will allow of dilution. Other substances which are present in the broth and which contribute to the reactions disappear to a large extent during the period of storage (aging) of the toxin.

The toxin, when freshly prepared, is unstable and deterioration takes place, the rate of deterioration being relatively rapid at first but gradually becoming slower and slower. After 6 months or longer, the toxin approaches a relative stability and is now used for the preparation of the toxin-antitoxin mixture.

\*From the Bureau of Laboratories, Department of Health, City of New York.  
Read at a Symposium on Modern Methods for Prevention of Diphtheria, at the New York Academy of Medicine, May 23, 1921.

†The smallest amount which will kill a 250 gram guinea pig in four days.

Several lots of such toxin are mixed to give a total of about 60 litres. The L plus dose is then determined. The L plus dose is that amount of toxin which, when added to one unit of antitoxin, will give a mixture which injected into a 250 gram guinea pig will cause death on the fourth day. The toxins used contain from 4 to 6 L plus doses per c.c.

As the convenient immunizing dose was set at one c.c. for each injection, it was desirable to have all the preparations of toxin-antitoxin mixtures standardized to contain the same immunizing value; we therefore set the standard at 3 L plus per c.c. Each mixture of toxin is consequently diluted with sterile salt solution, containing the required amount of preservative, to above mentioned standard.

An aged standardized antitoxin is then added to the toxin, one unit of antitoxin for each L plus. The mixture therefore is theoretically toxic as is evident from the definition of the L plus dose given. The use of this proportion insures against a possible over-neutralization. If the mixture is too toxic, more antitoxin can always be added; whereas at present we would discourage the addition of toxin to adjust an over-neutralized mixture.

The calculated amount of antitoxin to be used is greatly diluted and added slowly, under aseptic precautions, to the toxin which is constantly agitated to insure a complete mixture. This is then allowed to stand for 3 hours before the preliminary tests are made.

For the preliminary test 2 groups of guinea pigs are employed. To each of one group is given 1 c.c.; to each of the second, 5 c.c. The injections are made subcutaneously. If the mixture is properly adjusted at this stage, the pigs receiving 5 c.c. will die acutely, whereas those receiving 1 c.c. will show no immediate effect but will develop paralysis after 2 weeks.

If the mixture is too toxic, more antitoxin is added till the above condition is reached.

The mixture is now filtered through a Berkefeld filter and stored in the refrigerator for stabilizing. During this period the toxicity of the mixture decreases probably through further combination between the toxin and antitoxin and through some deterioration of the toxin itself.

The mixture is now retested using 3 groups of guinea pigs, injecting 1 c.c., 2 c.c. and 5 c.c. respectively.

The 1 c.c. group should show some local edema at the site of injection, some loss of weight but should not die. The 2 c.c. group will develop paralysis after about 18 days, dying on the twenty-first or twenty-second day. The 5 c.c. group will develop paralysis after about 15 days and die 2 or 3 days later.

If these results are obtained, the mixture is ready for use. If not, further adjustments become necessary. Such a mixture retains practically its full immunizing power for at least one year.

As is evident from the above, there is a tendency to a change in the balance between the toxin and antitoxin during storage. Is there a possibility that dissociation ever takes place, that is, that the mixture may become acutely toxic, and therefore dangerous for human use? All our knowledge concerning the combination of toxin and antitoxin speaks against such a possibility. We have retested our toxin-antitoxin mixtures, at first every month, later every 2 months, carrying such retests over a period of 2 years and never noticed any increase in toxicity. In fact, the tendency is the reverse, that is, a loss of toxicity varying in degree with different mixtures. As a rule, the power to produce paralysis persists if the mixture is correctly balanced at the beginning.

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## THE DURATION OF THE IMMUNITY CONFERRED BY THE USE OF DIPHTHERIA TOXIN-ANTITOXIN.\*

By M. C. SCHROEDER, M.D.,

Assistant Director, Bureau of Laboratories, Department of Health, City of New York.

The practical value of the toxin-antitoxin immunizing injections depends on several factors: the harmlessness of the injections, the proportion of the susceptibles who respond and become immune and finally the duration of the immunity. Active immunization would have been attempted on a large scale years ago except for the difficulty of identifying those who required protection. For 25 years it has been known that it was possible to immunize with the toxin-antitoxin. In fact in our own laboratory we learned this in 1896 and used the method practically in horses.

The suggestion of Schick that the introduction of a minute quantity of toxin in the skin would differentiate those that had antitoxin immunity from those that had none, made it possible to inject those who had no antitoxin and watch the results. This led Behring to undertake active immunization in Germany 9 or 10 years ago. His success encouraged us to undertake the same work in New York. After we had determined the harmlessness of the mixture and the percentage became immune after 1, 2 and 3 injections (see table), we realized that the all-important fact that remained to discover was the duration of the immunity. Even if we could make every child immune this would be of little practical value unless the condition remained permanent. We decided that the most favorable means of determining the truth as to this point was to seek institutions where the children were held for a number of years. Dr. Zingher and I picked out a number of institutions and we have followed the children from year to year. Five and one-half years have elapsed since the children in the first institution were treated. It is difficult to wait in patience for the years to pass to reach the final conclusion, but there is no other way. We have also tested over 4,000 inmates of the State Institution for the Insane, in order to obtain results on a group of people likely to remain located indefinitely, whereas in children's institutions the stay is often short and most of the children will have left in a few years.

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\*From the Bureau of Laboratories, Department of Health, City of New York.  
Read at a Symposium on Modern Methods for Prevention of Diphtheria at  
the New York Academy of Medicine, May 23, 1921.

TABLE I.  
SHOWING RESULTS OF 28 CASES DURING 5½ YEARS RE-TEST PERIOD

Schick Test		Toxin-Antitoxin—3 injections		Schick Re-tests during 5 years		Schick Re-tests during 5 years		Schick Re-tests during 5 years		Schick Re-tests during 5 years	
Nov. 16, 1915	Nov. 16, 1915	Nov. 20 & 25, Dec. 3, 1915	Nov. 29, 1915	Mar. 19, 1916	June 29, 1916	Nov. 9, 1916	July 22, 1917	Jan. 13, 1919	Jan. 11, 1921	Jan. 11, 1921	Jan. 11, 1921
Case 1	++	++	++	++	++	++	++	++	++	++	++
2	++	++	++	++	++	++	++	++	++	++	++
3	++	++	++	++	++	++	++	++	++	++	++
4	++	++	++	++	++	++	++	++	++	++	++
5	++	++	++	++	++	++	++	++	++	++	++
6	++	++	++	++	++	++	++	++	++	++	++
7	++	++	++	++	++	++	++	++	++	++	++
8	++	++	++	++	++	++	++	++	++	++	++
9	++	++	++	++	++	++	++	++	++	++	++
10	++	++	++	++	++	++	++	++	++	++	++
11	++	++	++	++	++	++	++	++	++	++	++
12	++	++	++	++	++	++	++	++	++	++	++
13	++	++	++	++	++	++	++	++	++	++	++
14	++	++	++	++	++	++	++	++	++	++	++
15	++	++	++	++	++	++	++	++	++	++	++
16	++	++	++	++	++	++	++	++	++	++	++
17	++	++	++	++	++	++	++	++	++	++	++
18	++	++	++	++	++	++	++	++	++	++	++
19	++	++	++	++	++	++	++	++	++	++	++
20	++	++	++	++	++	++	++	++	++	++	++
21	++	++	++	++	++	++	++	++	++	++	++
22	++	++	++	++	++	++	++	++	++	++	++
23	++	++	++	++	++	++	++	++	++	++	++
24	++	++	++	++	++	++	++	++	++	++	++
25	++	++	++	++	++	++	++	++	++	++	++
26	++	++	++	++	++	++	++	++	++	++	++
27	++	++	++	++	++	++	++	++	++	++	++
28	++	++	++	++	++	++	++	++	++	++	++

\*Thirteen received 2 injections 1½ c.c. 1-27-19.

\*Twenty received 2 injections 1½ c.c. 1-27-19.

Twenty-two of 28 became negative within 4 months and remained negative 5 years.

Twenty-five of 28 became negative within 6 months and remained negative 4½ years.

The remaining 3 became apparently—but relapsed more or less; but became permanently—after two additional injections.

Table I gives the test results in 28 children that have remained in one institution for 5 years.

It is seen that when once antitoxin develops in those injected with toxin-antitoxin it is quite or almost as persistent as in those who develop it naturally. It certainly lasts for at least 5 years.

*Response to Toxin-Antitoxin Stimulation in Infants.* Over 2,400 infants ranging in age from a few hours to 2 weeks were tested and immunized by Miss Denny, Miss Alper and myself; re-tested one year later, we found that only 50 per cent. had become immune. This showed that active immunity cannot be produced in these young infants by toxin-antitoxin injections owing to the inhibitive effect of the passive immunity derived from the mother. This passive immunity is lost later. Consequently toxin-antitoxin can only be depended upon to act effectually after the age of six months.

*Response in School Children.* Another side of the problem was presented by the use of toxin-antitoxin among the public school population. During the past 2 years fully 50,000 children attending the public schools of Brooklyn have been Schick tested and immunized under my personal supervision.

During the past month we have begun re-testing those children who were immunized.

The results are given in Table III:

School	No. of Children Retested	No. of Children Becoming Negative	No. of Children Remaining Positive	Percentage Becoming Immune
P.S. 16, Bklyn.	288	260	28	90%
P.S. 142, Bklyn.	157	148	9	94%
P.S. 50, Bklyn.	125	119	6	95%

The above children received three doses of 1 c.c. each. In P. S. 149, Brooklyn, 35 children received two doses of 1½ c.c. each. Of these children, 26 became negative, 9 remained positive and were re-injected. The latter will be tested again later.

*Acquired Immunity in Adults.* During the past year 4,396 inmates of Kings Park State Hospital were Schick tested and 555 patients were immunized. These patients were divided into 2 groups, Group A receiving one dose of toxin-antitoxin and Group B, two doses in 1½ c.c. doses.



TABLE II.

	Total Tested	Doses T A T	Months After	Schick Results	Re-test Percentage Becoming Immune
St. Joseph's	12	3	60	11 —	
Ages mostly	38	2 & 3	*38	*1 + 38 —	100 100
				Boys Girls	
5-10 years.	78		10	64 — 9 + 5 +	94
	120	2 & 3	3	*91 — 11 + 18 +	85
St. Agnes	8	1 & 2			
3-14 years.	3	2	60	3 —	100
	25	2	20	25 —	100
				Girls Boys	
	54	2	12	50 — 4 +	92
	38	2 & 3	38	33 — 2 +	94.8
St. Dominick				6 — 1 —	
Ages mostly	10	1	31	1 + 2 +	70
9-12 years	16	2	18	14 — 1 + 1 +	93.8
St. Malachy's				13 —	
Ages (5-15 yrs.)	14	2	14	1 —	100
Randall's Island				42 — 4 —	89.2
(5-30 years)	49	2	33	2 + 1 +	94.9
Hebrew Orphan	68	3	32	59 — 3 —	92.6
Asylum (5-15 yrs.)				4 + 2 +	
Mt. Loretto	83	1 & 2	3	62 — 12 —	
				3 + 7 +	77.5
House of Refuge	7	1 & 3	35	4 — 2 —	71.5
(10-20 yrs.)				1 +	
Leake & Watts	32	3	27	26 — 2 —	93.8
(5-15 yrs.)				3 +	
	23	2 & 3	24	19 — 3 +	82.6
N. Y. Catholic	19	3	6	17 — 2 +	89
Protectory.				1 +	
(4-10 yrs.)	20	3	12	18 — 1 +	95
	55		22	53 — 2 +	96.4
N. Y. Foundling	32	3	17	30 —	96.9
(1-5 yrs.)				1 + 1 +	
Chldrns. Stations	350	3	7	314 — 37 +	89
3 mos. to 4 yrs.					

\* 1 case became positive, but reinjected became negative.

The results upon re-test were as follows:

Group	No. of Cases	Reaction Changed From Positive to Negative	Reaction Remaining Positive	Percentage Becoming Immune
A	105	85	20	80%
B	245	209	36	85%

Such, in brief, is a résumé of part of the work done during the past 5 years to test out the possibilities of the duration of conferred immunity by means of diphtheria toxin and antitoxin mixtures.

Over 28,000 cases of diphtheria occurred in New York City during the years 1919-1920 and of the 2,284 persons who died, over 90 per cent. were children and that at least 90 per cent. of these cases of sickness and death could probably have been prevented by means of the Schick test and immunization with diphtheria toxin-antitoxin. When we realize all this should it not spur us on to work toward that day when diphtheria shall become like smallpox—one of the rare diseases.

Ott and Roy<sup>8</sup> in a small number of cases used iodized phenol with satisfactory results. In pharyngeal cases, the tonsils, uvula and posterior wall of the pharynx were swabbed every 48 hours until negative cultures were obtained. In nasal cases, the entire anterior part of the nasal cavity was swabbed with iodized phenol every 48 hours. Zingher<sup>9</sup> states that all infants below 12, and if possible below 18, months of age should be actively immunized with 3 doses, each 1.0 c.c. of toxin-antitoxin. These injections should be given irrespective of the Schick test the infants may show at the time of immunization. All children over 18 months of age, as well as all youths and adults, should be tested with the Schick reaction first, and only those giving a positive reaction immunized with toxin-antitoxin.

Geiger, Kelly and Bathgate<sup>10</sup> used the Schick test to distinguish between contacts and carriers, without waiting for the elapsing of the incubation period. In the group in which this was done all were found immune and were accordingly classed as carriers, and so relieved of some of the inconveniences attending the quarantine of contacts.

8. Jour. A.M.A., March 11, 1916, p. 800.

9. Am. Jour. Dis. Child., Aug., 1918, p. 83.

10. Jour. A.M.A., February 26, 1916, p. 645.

DISCUSSION OF PAPERS READ AT A SYMPOSIUM ON  
MODERN METHODS FOR PREVENTION OF DIPHTHERIA  
HELD AT THE NEW YORK ACADEMY OF  
MEDICINE, MAY 23, 1921.

DR. LOUIS I. HARRIS said that he had no substantial contribution to make to the comprehensive exposition of the subject under discussion, but that in the list of characters who had been cast to present the dramatic preventive activities in the effort to combat diphtheria he figured only as a spear-bearer or "super." He felt that his invitation to discuss the paper was in the nature of a generous and handsome gesture on the part of Dr. Park to a fellow member of the Health Department's Committee to Promote the Schick Test and Active Immunization. However, he might speak of the work from the public health standpoint. The community ought to be grateful to Dr. Park for having helped establish the Schick test and the use of toxin-antitoxin on a firm foundation with the aid of his devoted and loyal staff. It was generally recognized that he had accomplished this, and emissaries were now coming from all parts of the country to study the Health Department's methods with a view to applying them in their own localities.

Dr. Park was truly to be congratulated, for if he had accomplished no other scientific achievements, this alone would mark him as worthy of the public gratitude.

In a promiscuous and crowded population, such as that of the city of New York, there were many diphtheria carriers and contact with them was inevitable. According to the estimates of Weaver, and of Hartley and Martin and others, there was probably a total of from 160,000 to 200,000 diphtheria carriers in the city, during the winter season. It was a marvel that we did not have a larger number of diphtheria casualties. While we may estimate the direct or immediate mortality and morbidity from diphtheria, who could tell to what extent diphtheria and its sequelae were responsible for many of the ills of adult life. Because of its effect on the heart and kidneys, who could say how great a part diphtheria is playing in causing diseases of these organs which become manifest in adult life. Surely the problem

of controlling diphtheria was enormous and the Schick test and toxin-antitoxin immunization bid fair to solve it. The present faith in the universal efficiency of the Schick test recalled the situation in respect to typhoid prophylaxis when anti-typhoid inoculation was first introduced. It was thought that it would be universally effective, but we learned in the war that there were exceptional cases in which typhoid inoculation failed to give immunity. The same mistake should not be made in regard to the Schick test. We should be guarded in our promises of its ability always to confer immunity. We should not instil the thought that the Schick test and toxin-antitoxin immunization offered a *sure protection* against diphtheria.

A point brought out during the discussion but not sufficiently stressed was that if the Schick test were read too early a positive reaction might be overlooked. One could be sure of the reading only on the third, fourth or even fifth day, after its administration. The work of Weaver, and of Hartley and Martin and others, brought that point out strikingly, how frequently diphtheria cultures taken to terminate quarantine in cases of diphtheria misled those who relied upon the evidence of a single, or even of 2 negative cultures. He pointed out that we had been compelled to make an oblique attack upon diphtheria through the use of the Schick test and toxin-antitoxin because the direct attack in terminating the carrier state had failed.

If the people were to reap the full value of the Schick test and of active immunization against diphtheria, the coöperation of the medical profession was essential. They should remember that every physician, if he were doing his full duty, was an unofficial health officer. The medical profession should supplement and extend the work of the Health Department as Dr. Byard had done, even though they might not be able to do so on as large a scale. In that way only, the frightful mortality from diphtheria could be controlled.

DR. JACOB SOBEL stated that his experience with the Schick test for the detection of diphtheria susceptibles and for the production of active immunity in these susceptibles by the administration of toxin-antitoxin, had been derived from private practice and from his rather extensive supervision of this work for the Bureau of Child Hygiene of the Department of Health, which is charged

with the administrative health control of children from birth up to the age of 16 years.

Dr. Park and his group of pioneer workers in this field have told us that within the past 25 years there has been a reduction in the mortality of this disease of from 150 to 22 per 100,000 of the population. During the last 10 years, however, the mortality and morbidity from diphtheria had remained practically stationary. It seemed as if we had reached the limit of possibilities of control by means of the methods at our disposal, namely, the use of antitoxin therapeutically and prophylactically, isolation, quarantine, hygienic and sanitary measures, etc. Dr. Sobel stated that his remarks would be confined to the clinical, administrative and educational aspects of the subject, inasmuch as the papers had taken up the scientific side so thoroughly.

There were 2 outstanding reasons why further progress in the control of diphtheria had been limited. The first was because of the fact that one-half or more of the cases of diphtheria gave no history of having been exposed to active or convalescent cases of this disease; and secondly, because of a large susceptible population. Why, then, if half or more of the cases did not come in contact with active or convalescent cases of this disease was there so much diphtheria? It seemed to him that the reasons for this were threefold—first, carriers; second, missed-cases; third, nasal diphtheria. Dr. Harris had spoken of the large number of carriers extant in this community. It has been estimated that at certain seasons of the year 1 to 2 per cent. of the population of approximately 6,000,000 harbored diphtheria bacilli, of varying degrees of virulence. This, however, did not cover the situation entirely because there was in New York City a daily floating population of approximately 500,000, which had a similar percentage of diphtheria carriers. Furthermore, from studies conducted by the Bureau of Child Hygiene and from the contributions of Weaver, and by Moss and his co-workers, in a recent issue of the Johns Hopkins Hospital Bulletin, we know that among children the percentage of carriers is from 4 to 8 per cent. Since children come in contact more generally with those of their own kind and age, the significance of this high percentage of carriers among them is evident.

By missed-cases we refer to that large group of sore throats, either angina or follicular tonsillitis, which were either true cases

of diphtheria or carriers and which were frequently unknown, unsuspected, undiagnosed and untreated, and which, by mingling with the general population, disseminated diphtheria. It was this type of case that explained what Dr. Zingher referred to, namely, "the larger percentage of positive 'Schicks'" among the children of the well-to-do, or, in the better schools, so-called, as well as the larger number of susceptible children in rural districts and rural schools. Closer association and more intimate contact among the poorer element resulted in greater spread of these cases with resultant establishment of artificial immunity.

The third source of infection was the mild cases of diphtheria. Dr. Sobel was convinced that these cases were of far greater frequency than was generally known or admitted. The severe cases were readily recognized, isolated and treated, but the mild cases, those with muco-sanguinous discharge, slight, moderate or no temperature, sub-maxillary adenitis, etc., very often escaped detection and literally poured out diphtheria bacilli. These cases are not infrequently looked upon as "cold in the nose" and by associating with others spread the disease.

Add to these 3 great sources of contagion the large percentage of susceptibles, and the need for the Schick test and production of active immunity becomes apparent. We have learned through Dr. Park's school that the greatest number of susceptibles was found among children between 1 and 2 years of age, or, as a group, in children of the pre-school age, from 2 to 6 years. Sixty per cent. of susceptibles are found at this age period. Why then, was the problem first attacked among children of the school age?

In the public and other schools we had at our disposal approximately 1,000,000 souls readily accessible, easily supervised, easily controlled, easily followed up. Among this number there is 25 to 30 per cent. susceptible to diphtheria. This percentage is even higher for the kindergarten children and children admitted to school for the first time. It was felt that if we could immunize this 25 to 30 per cent. we would control just that number of potential cases of diphtheria, remove them as a source of community danger, and protect the younger children of the family for the future. Through the school authorities and the school children a vast amount of educational propaganda could be instituted. Most important of all was the fact that through the work

in the schools the public could be taught. The public must be educated up to all types of preventive health work. They are not so ready to accept preventive measures which are associated with the injection of heterogeneous substances into the body. We felt that as the public would learn through the school children that the Schick test was harmless and that the injections of toxin-antitoxin were comparatively free from ill effects, they would gain confidence in the procedure, and that then, as a matter of course, they would be ready and willing to have it applied to the large susceptible element of the population,—the children of the pre-school age.

DR. EVERETT W. GOULD said that these interesting and valuable papers had covered the scientific aspect of the subject so thoroughly that it seemed best to give the experience with the Schick test and the protection of susceptibles at St. Luke's Hospital. They had been relying upon the Schick test in all cases entering the hospital, both surgical and orthopedic as well as the medical cases. All those giving a negative Schick test were not immunized while those giving a positive test were thoroughly immunized. Since this procedure had been adopted 7 years ago, they had not had more than 4 cases of diphtheria in children developing among those who had previously shown a negative Schick reaction. Those cases were all given antitoxin and recovered. It is impossible to say whether these were true cases of diphtheria developing in children previously showing a negative Schick reaction or diphtheria carriers who had developed tonsillitis, or more likely were instances where the Schick reaction had been falsely reported as negative as a result of a mistake in the technique, or in the interpretation of the reaction. He thought that the fact that only 4 cases of diphtheria developed among the hundreds and thousands that had been subjected to this test was an excellent argument in favor of this method.

About 5 years ago a nurse had a Schick test made by a capable man and reported as negative. About 4 weeks later she developed a sore throat which gave a negative culture, although clinically it resembled diphtheria. On account of the previous negative Schick no antitoxin was given. Two days later the nurse developed laryngeal diphtheria but after large doses of antitoxin were administered she recovered. That was reported as a probable

instance in which an individual with a negative Schick reaction developed diphtheria. Two years later and again recently she showed a slightly positive Schick. This means undoubtedly an error had originally been made either in the test or in its interpretation.

Last year Dr. Gould said they had a slight epidemic of diphtheria in a surgical ward, there being 2 cases in children and 2 cases in nurses. Careful investigation showed that one child had had its Schick test read in 24 and 48 hours, but on the fifth day it was not read. He believed that if the test had been read on the fifth it would have been found to be positive. They had frequently found that reading the reaction on the second day and third day was not sufficient. It should be read also on the fourth day or better even on the fifth.

The second case of diphtheria occurred in a child whose Schick test was reported positive, but through some error the child had not been immunized. One of the nurses was subsequently found to have a mild positive Schick test; the other had a mild form of throat trouble which subsided without antitoxin and they thought that probably she was a carrier. From their experience they could say that they believed the Schick test to be a most dependable method of determining the susceptibility to diphtheria and cases reported in which it had apparently failed were probably instances where errors had been made either in the technique of the test or in its interpretation. It is very easy for one unfamiliar with the details of the test to make such errors. All cases showing evidences of clinical diphtheria, even though credited with a negative Schick, should receive antitoxin for fear an error may have been made in the previous test. If a blood examination can be made to determine its antitoxin content in such a case the antitoxin may be withheld for a few hours to await the result, for there is, of course, no advantage in giving antitoxin to one who already has sufficient supply in his blood even though he has virulent germs in his throat.

MR. GEORGE R. BEDINGER stated that he represented the New York Chapter of the American Red Cross, and being a layman felt doubly honored in being able to say a few words. The starting point of all the work of the American Red Cross was that public health was the job of public authorities in the long run.



The work of the Red Cross was simply to tie together the activities of other agencies in the community and to place them on a basis where they could offer a more coherent and effective organization for work along public health lines. The majority of their activities were in the nature of a demonstration and whenever the public health authorities come to regard these demonstrations as practical the American Red Cross welcomed that time and were glad to have the public health authorities take over such activities. The reason they had become interested in the application of the Schick test was because Homer Folks and Dr. Copeland had asked them to help to meet an emergency occasioned by the fact that the Board of Estimate refused to make an appropriation which would enable the Department of Health to carry out the work of Schick testing and immunizing public school children against diphtheria. They saw in the Schick test the opportunity for doing a great work in the community and it had given them great pleasure to be associated with Dr. Park and his associates in this activity. Dr. Park presented the subject to them and told them that he needed money and personnel to carry on the work and to demonstrate what could be done in the control of diphtheria. It had been a great pleasure to be associated with Dr. Zingher in the practical work among the school children. He hoped Dr. Zingher would pardon him if he attempted to make one point a little clearer. Dr. Zingher had mentioned that the Red Cross was going to establish a health center in East Harlem. He wished to say that the American Red Cross was only one of the agencies interested in this project. The Red Cross was going to provide a building and personnel and other organizations in that locality would work with them in these headquarters, the headquarters being merely the Red Cross contribution to the work.

Dr. Zingher invited those in the audience who might wish to see a demonstration of the method used in making the Schick test to remain after the meeting when he gave a practical demonstration.

## MISCELLANY

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### A PLEA TO PHYSICIANS TO EMPLOY ACTIVE IMMUNIZATION AND SO PREVENT DEATHS FROM DIPHTHERIA.\*

In 1895, when diphtheria antitoxin first came into general use for treatment and passive immunization, we felt hopeful that diphtheria would be robbed of its terrors. To a considerable degree this hope has been realized. Twenty-five years ago, about one hundred and fifty persons out of every hundred thousand in our population died of diphtheria; at present only eighteen persons in every one hundred thousand succumb to the disease. Notwithstanding this improvement, 14,166 cases were recognized as diphtheria and reported to the Health Department last year; of these 1,045 cases died. What is more discouraging is that there has been no recent improvement.

We realize, therefore, that we have won only a partial victory over this justly dreaded disease.

There has recently been developed a test for identifying persons who are susceptible to diphtheria, and a *new method* of immunizing such persons. This treatment becomes effective after a few weeks, apparently gives life-long protection, and promises practically to wipe out diphtheria from our community, if private physicians will help. These procedures are so new that very few physicians have had opportunity to become acquainted with them. This article is published in order to give this information as briefly as practicable, and to secure the aid of physicians to help in eliminating this disease.

*What Benefits Have We Derived From Antitoxin?* When the familiar antitoxin is used as an immunizing agent, its protective action becomes effective in a few hours and continues for an average period of about two weeks. Antitoxin is therefore of value when children who are known to be susceptible, or who have not been tested as to susceptibility, are in contact with a case of diphtheria, and immediate protection, even though of short duration, is desired. In the treatment of diphtheria, antitoxin,

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\*A Pamphlet issued by the Department of Health, City of New York, Bureau of Preventable Diseases, Bureau of Laboratories, 1921.

when given early enough, and in a sufficient dose, has been found to be remarkably successful.

*The Shortcomings of Antitoxin.* As already stated, the injection of antitoxin for immunizing purposes gives protection for a very brief period only. The antitoxin protein which is produced by the horse, is not retained by man as it is when produced by him. To be effectual for protection over a prolonged period, injections of antitoxin would have to be repeated every two weeks. This is utterly impractical as a general method of immunizing the children of a large community.

So far as treatment is concerned, our present method of using serum has been so improved that we cannot save a larger percentage of our diphtheria cases than we now do. Unfortunately, the therapeutic success of antitoxin is limited because many cases are not recognized and reported to physicians until too late, and because physicians sometimes fail to take cultures in suspected cases or to recognize early enough the seriousness of an attack of diphtheria, or because they fail to administer a sufficiently large dose of antitoxin without delay. Success in treatment is also limited because of early complicating infections due to streptococcus and pneumococcus, which gain rapid headway and render us powerless to prevent broncho-pneumonia and other dangerous complications.

*Carriers Make the Prevention of Diphtheria Most Difficult.* The chief difficulty in the prevention of diphtheria has been the great number of healthy persons who carry diphtheria bacilli in their throats. In the winter season it has been found that more than one per cent. of our population are diphtheria carriers. In other words, there are in this city, during the winter, more than sixty thousand healthy persons who, if diphtheria cultures could be taken from the throats of the entire population, would be found to be carriers. It is manifestly impossible to isolate such vast numbers, even if it were not utterly hopeless and absurd to attempt ever to examine the entire population in order to detect all carriers. These carriers transmit the disease in spite of all that has previously been done to prevent it. More than one-half of all diphtheria cases are persons, who so far as can be ascertained have not been in contact with a known case of diphtheria. The remedy for this situation is the use of the Schick test in order to single out those who are susceptible, to be followed, when a

positive reaction is obtained, by active immunization with toxin antitoxin. The latter method produces immunity of long duration, or possibly of a permanent character.

*The Schick Reaction—Its Significance.* The results of combined clinical and laboratory experience in testing the blood for the presence of antitoxin in cases of diphtheria, and in persons who have been in contact with the disease, have shown that only those individuals contract diphtheria who have no antitoxin or only a minute amount of it in their blood and tissues. Schick, in 1913, published a description of a simple clinical test by which this amount of antitoxin can be accurately ascertained. The reaction depends upon the local action of minute quantities of diphtheria toxin when injected intracutaneously. If antitoxin is absent or present only in very small amounts, insufficient for protection from diphtheria, a positive reaction will appear at the site of injection in from twenty-four to seventy-two hours. The Schick test separates the non-immunes from the immunes. By it we recognize those who are in danger of infection. To such persons, we afford protection by prompt removal from contact with the patient and by injection of antitoxin to evade *immediate* danger of infection. Such cases should receive lasting protection through active immunization.

*The Positive Reaction.* A positive reaction is recognized by a circumscribed area of redness and slight skin infiltration which measures from one to two centimeters in diameter. It persists for seven to fourteen days, and on fading, shows, as a rule, a superficial scaling and a rather persistent brownish pigmentation. The amount of toxin injected, as advised by Schick is 1/50 M. L. D. (minimum lethal dose) for the guinea pig, in 0.1 c.c. of normal saline. We prefer 1/40 M. L. D. in 0.2 c.c. It is desirable to give exactly 0.2 c.c. but even amounts, such as 0.1 c.c. and 0.3 c.c. give fairly consistent results—the area of redness being smaller when 0.1 c.c. is given and larger where 0.3 c.c. It is necessary to give *intracutaneously* so that the toxin will not be too rapidly absorbed but remain in the dense tissue and have time to exert its irritant action. The slightly raised white area, at the point of injection, is infallible evidence that the diluted toxin has been delivered intracutaneously. In infants under one year, 0.1 c.c. is sufficient, but it is safer to give 0.2 c.c.

*The Pseudo-Reaction.* Schick soon noticed that in the older children and adults, a considerable percentage showed a reaction,

which usually could be distinguished from the typical reaction, which was due to proteins and which had nothing to do with the toxin. In most cases, this reaction came on more promptly, covered a larger surface, was more of the urticarial type, and disappeared within three days. Pigmentation was absent or slight. In a small percentage, however, the reaction persisted and it was very difficult to decide between a true and a pseudo-reaction. When there was a combined reaction it was even harder to decide how much was due to the toxin and how much to the non-toxic protein, because the development of a specific toxin reaction in no way prevented the protein reaction. The best practice, therefore, in adults is to inject the toxin in the skin of one arm, and the heated or antitoxin neutralized toxin in the other arm. In this way the amount of protein reaction can be noted, and it can be decided whether the reaction, following the toxin is a simple true reaction, a pseudo-reaction, or a combined reaction. Even after one has been thoroughly trained, it is still wise to use the two injections, when possible. On other occasions, when only one injection is made, *any cases which remain in doubt are to be re-tested or considered as true reactions.*

It is apparent that the technique of the Schick reaction, although very simple, must be carried out with the greatest accuracy, or the results will be entirely misleading. If the toxin has been diluted it gradually deteriorates and, if instead of giving 0.02 of a fatal dose for a young guinea pig (M. L. D.) only a fraction of that amount is injected, no toxic reaction will occur, and misleading results will be obtained.

To carry out the test, it is essential to have a good syringe, with a sharp, but short-pointed, fine needle. Most persons prefer a needle with a length of one-half or one-quarter inch. The usual 1 c.c. "Record" syringe, with a fine platinum-iridium needle, or a 26 gauge  $\frac{1}{4}$  or  $\frac{1}{2}$  inch steel needle, answers the purpose well. The Health Department furnishes a standard diphtheria toxin contained in capillary tubes in such amount that the contents of one tube added to 10 c.c. of water give the required dilution. The dilution will keep in the ice-box with little deterioration for at least twelve hours.

Though the intensity of the reaction varies in different individuals, a well-marked redness indicates an almost complete absence of antitoxin in the individual tested. Faint reactions point

to the presence of very small amounts of antitoxin, which are not sufficient, however, to certainly protect the individual against diphtheria, but would probably protect from systemic intoxication.

*The Practical Value of the Schick Reaction.* The Schick reaction has been carried out during the past six years on all patients entering the scarlet fever pavilion of the Willard Parker Hospital. Only cases giving positive reactions were immunized against diphtheria; those giving a negative reaction received no immunization, but were carefully observed. Although many of the negatively reacting patients became carriers of virulent diphtheria bacilli during their stay in the wards, no cases of clinical diphtheria developed among them. The patients who gave positive reactions, received, in practically all cases, injections of diphtheria antitoxin.

The percentage of individuals susceptible to diphtheria is shown by the Schick test to be greatest between the ages of one and four years. It is less during the second six months of life, and less in older children, and least in adults, and in infants under six months. In adults, the positive reactions were not more than 12 per cent.

*Susceptibility of Various Ages to Diphtheria* (as indicated by the Schick diphtheria-toxin skin test.)

<i>Age</i>	<i>Susceptible</i>
Under 3 months .....	15 per cent.
3 to 6 months .....	30 per cent.
6 months to 1 year.....	60 per cent.
1 to 2 years.....	60 per cent.
2 to 3 years .....	60 per cent.
3 to 5 years .....	40 per cent.
5 to 10 years .....	30 per cent.
10 to 20 years.....	20 per cent.
Over 20 years .....	12 per cent.

*Permanence of Negative Reaction in Persons Developing Natural Immunity.* For the past five years, we have been testing and re-testing thousands of children in institutions and keeping records. We found, with very few exceptions, that those who gave a negative Schick test continued to show immunity from year to year. From this, and the fact of the age distribution of

immune children in families in which the younger have a positive reaction and the older children and adults a negative reaction, it would seem that when once a child develops natural immunity this is probably a lifelong possession. It is true that we have found a yearly variation in about 2 per cent. of the cases, i. e., that children noted to have had a negative Schick reaction, have at some time shown a positive reaction. It is our belief that most of these supposed changes in reaction are not actual but are due to different strengths of the toxin solution used in making the intracutaneous test or in the time of reading of the reaction. More careful observations in the future will show whether this opinion is correct or not. Where the same observer made the tests, there were practically no changes from negative to positive reaction.

A matter of much practical importance is whether a person with sufficient antitoxin to give a negative reaction has sufficient to prevent the development of diphtheria. We have been so in the habit of considering that a positive culture on Loeffler's blood serum indicated that the case had diphtheria, that we have lost sight of the true fact, which is that such a culture simply indicates that the case is a carrier. By tests we know that many of the bacilli found are absolutely non-virulent. It is an undoubted fact that a person who is a carrier of virulent or non-virulent diphtheria bacilli may be afflicted with a septic tonsillitis due to the streptococcus or other micro-organisms. When a case of doubtful diphtheria has a negative Schick test and a positive culture, it is extremely difficult to decide how to consider the case. From the practical standpoint antitoxin should be given because there is always a possibility that there has been some error in the technique of the test, or in its reading, or some mistake as to the identity of the individual. It seems safe to rely on the belief that a person with a sufficient amount of antitoxin to give a negative Schick test is incapable of developing constitutional toxæmia, or a severe infection from diphtheria bacilli. There is a doubt as to whether very slight infections of the superficial mucous membrane may occur in such persons. In our opinion cases supposed to be of this character are usually instances of infections from other microbes, the diphtheria bacilli being also present as in a carrier. Those that show a faintly positive Schick test are probably liable to moderate local infections.

*Toxin-Antitoxin Vaccine.* Diphtheria toxin is so poisonous, that in order to use it for the purpose of immunizing human beings or animals it is necessary to begin with minute doses. The amount of each successive dose is very gradually increased. This process consumes much time and unless carried on with the utmost skill and patience it is not wholly safe. Experimenting on guinea pigs with mixtures of toxin and antitoxin it was found that the toxin could be neutralized to the extent of not being poisonous and yet have the power to stimulate the development of antitoxin.

It is true that any given amount of toxin neutralized by antitoxin would have much less stimulating effect than the same amount of unchanged toxin, but this difference was not important, because the harmlessness of the neutralized toxin permitted several hundred times as much to be given safely at the initial dose as of the pure toxin. The usual injection for all ages is approximately 400 times the fatal dose for a half-grown guinea pig, to which has been added just sufficient antitoxin to neutralize it. This is about four units of antitoxin. The injection usually contains 1 c.c. of fluid and is made subcutaneously. The mixture is tested very carefully for its harmlessness before being used, and if so tested is absolutely safe. As it ages, the toxin disappears more rapidly than the antitoxin. A second and third injection of the same amount made at weekly intervals add greatly to the quantity of the antitoxin development from the first injection.

*The Local and Constitutional Reaction.* The diphtheria toxin-antitoxin mixture contains besides the neutralized toxin a considerable amount of protein substance. This is partly formed of the proteins originally present in the broth in which the bacilli were grown and partly from the remains of broken down or digested bacilli in the cultures. The reaction to the protein in the injection is similar to the reaction to the typhoid vaccine but it is of less severity.

The element of age is very important. The infant shows in the great majority of cases neither a local nor a constitutional reaction, while grown up children and adults exhibit in perhaps 30 per cent. of the cases considerable local swelling and more or less definite constitutional disturbances. Within 24 to 72 hours all disturbance is over. No lasting deleterious results have oc-



curred. Children of ages between one and ten years vary in the amount of reaction according to their age. The youngest shows the least and the oldest the most.

*The Immunization Response in Susceptible Children.* Those persons who are naturally immune against diphtheria are usually so from having antitoxin, but may be so from the possession of other protective substances. The antitoxin we can measure by the Schick test, but we have no practical way to detect the bactericidal substances.

*The Immunizing Results.* These are measured by the percentage of susceptible persons who become immune, and by the persistence of the immunity. The antitoxin develops slowly after the injections are begun and gradually increases. In only a few cases does an appreciable amount of antitoxin develop in less than three weeks after the first injection. The majority respond during the second month. There are a few who become fully immune only during the sixth month. The results in 529 children who were carefully observed were as follows:

Number of Doses of 1 c.c. Toxin Antitoxin	Number of Children	Number of Children Immune Three Months After Injection	Per Cent. Immune After Three Months
1	239	175	73
2	89	80	90
3	201	191	95

These figures approximately agree with our results in thousands of cases. In young infants who are still retaining their parents' antitoxin, transferred to them passively before birth, we have less successful results. Tested one year afterwards only about fifty per cent. were found to be immune. This percentage is about the same as among those not treated. Some 2,400 infants of an age under one week have been treated with absolutely no bad effect.

*The Duration of Immunity.* Our observations have covered a period of over four years, have included nearly 5,000 cases, and up to the present time the immunity has persisted in more than 90 per cent. of the first hundred treated. It seems as if the

stimulus of the injections arouses dormant cell activities to produce antitoxin and that this production having once started continues without further specific impulse. Immunizations become effective at the age of six months, the most favorable age period for its administration is from six months to five years.

*The Cause of Natural Immunity.* We have absolutely no knowledge of the stimulus which excites the cells to produce this natural characteristic antitoxin. The fact that a greater percentage of city as contrasted with country inhabitants are naturally immune might be partially due to so many being at one time or another carriers. The fact that horses and many animals possess natural diphtheria antitoxin and that it usually develops at a definite age and that it remains present throughout the duration of life indicates that this at best can only be a partial explanation.

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Friedberg<sup>11</sup> believes that in persistent carriers it may be necessary to remove the tonsils and adenoid tissue, if it is desired to terminate promptly the carrier condition. He deems it advisable to delay operation for two or three weeks after the clinical recovery of the patient.

Alden<sup>12</sup> in 15 out of 16 cases cleared the throat of B. diphtheria after other methods had failed with a spray consisting of a broth culture of staphylococcus pyogenes aureus.

McCord, Friedlander and Walker<sup>14</sup> recommend the placing of diphtheria carriers in the hands of competent throat specialists. The treatment they advise was the elimination of existing throat lesions. Tonsillectomy was carried out in a number of cases with a quick termination of harboring organisms in all cases. In addition, a systemic treatment with chloramin-T (chlorezene) was inaugurated. Through the use of these several described procedures it was possible to return the carriers to duty after an average of 23 days in hospital.

Keefer, Friedberg and Aronson<sup>15</sup> state, that local applications having proved unreliable in the treatment of the carrier state, operative interference is the only solution of the problem, especially in those cases in which the tonsils can definitely be shown to be the focus of infection.

11. Jour. A.M.A., March 11, 1916, p. 810.

12. Jour. A.M.A., June 14, 1913, p. 1876.

14. Jour. A.M.A., July 27, 1918, p. 275.

15. Jour. A.M.A., October 12, 1918, p. 1206.

## DEPARTMENT OF ABSTRACTS

### PROGRESS IN PREVENTION OF DIPHTHERIA\*

Park<sup>1</sup>, in his history of diphtheria, states that the results published prior to the investigations of Loeffler, were so inconclusive that many different kinds of bacteria were under consideration as the possible cause of the disease. Loeffler, in 1884, reported the results of a very careful series of studies. He came to the conclusion that, in diphtheria also, the chain forming micrococci were merely of secondary importance, occasionally invading the body under favorable conditions and giving rise to slight or grave local and general complications. But the results of animal tests established for all time the rôle of the diphtheria bacillus as the sole essential exciting factor in producing diphtheria. The idea of Loeffler that the lesions distant from the original site of the disease were caused by soluble poisons was proved correct by the work of Roux and Yersin. Numerous tests by means of animal inoculations in cases of croup, occurring in many parts of Europe and America, showed that the opinion of Bretonneau, that fatal croup was almost invariably laryngeal diphtheria, was absolutely correct. Behring discovered that not only was an animal, after recovery from a less than fatal dose of diphtheria toxin, immune to an otherwise fatal dose of a diphtheria culture, but also the far more important point, that the blood serum contained the protective substance and that this, injected into another animal, conferred immunity. By testing a number of animals it was found that the horse produced the largest amount of this protective substance. By judicious treatment with repeated inoculations of toxins, the antitoxin accumulated in the blood, since it was so slowly eliminated, and the newly-formed antitoxin after each injection was added to the major part of that formed in response to the previous injections. It was found that when an animal is injected with the antitoxin produced by one of its own kind, its immunity lasts from 4 to 6 months, but when injected with antitoxin produced in another species, immunity lasts only 2 or 3 weeks. Park, in his experimental tests in animals, proved that as soon as antitoxin enters the blood stream it neutralizes any toxin present, but that it only slowly passes through the capillaries to reach any toxin which has passed out previously or is still retained in the mucous membranes at the site of the

\* See also pages 335, 372 and 388.

1. Park, W. H.: *Defense of Research*, Pamphlet 22, 1911.

disease. When antitoxin is subcutaneously injected, it is absorbed quickly enough to render the blood current feebly antitoxic within a few minutes, but strongly so only after several hours, for the antitoxin is apparently chemically allied to the globulins and, like them, is slowly absorbed. He demonstrated, however, by animal tests that by injecting antitoxin into the vein of a patient, we immediately stop further passage of toxin from the blood stream, and, within a short time, we neutralize any toxin in the tissue fluids and so prevent further injury of cells whether situated at the point of disease or at distant parts. Antitoxin is really therefore, a preventive of further poisoning and cannot restore to health those who have suffered irreparable injury. In cases of diphtheria treated early, the lesions will not advance. In early cases the patients will recover and in the more advanced cases they will improve at least locally, but in many cases they will die from paralysis due to the progress of degeneration from previous injury or complications such as pneumonia, due to bacteria, the toxins of which are not neutralized by diphtheria antitoxin. Serum carrying the antitoxin is apt to produce after-effects of varying intensity. Von Pirquet and Schick have given it the name "serum sickness." After an incubation period which usually covers from 5 to 12 days, local redness and itching or swelling surrounded by urticarial wheals develop. This is followed by swelling of the lymph nodes, fever, a rash which may spread over the body, edema and swelling of the joints. In some cases, the reaction occurs more quickly. This immediate general reaction may be severe and alarming; in a very few instances it has been fatal. Rosenau and Anderson, Otto and others observed the result of the second injection in guinea pigs. They found that serum itself gave no toxic effects on the first injection, but if a certain time was allowed to elapse the succeeding injections were toxic. Von Pirquet also found that when a second injection in man gave symptoms, these came on much more quickly, at times immediately, instead of occurring after an incubation period of some days. An interval of about 10 days must elapse between two injections for this change in reaction to become evident. Park and Zingher<sup>2</sup> give a brief review of the Schick reaction. This reaction depends on the local irritant action of minute quantities of diphtheria toxin when

2. Park, W. H. and Zingher, A.: *Proc. N. Y. Pathological Soc.*, 1914. Vol. 14, p. 151.

injected intracutaneously. If antitoxin is absent, or present only in very small amounts, insufficient for protection, a positive reaction will appear in 24 to 48 hours. This is characterized by a circumscribed area of redness and slight infiltration which measures from 1-2 cm. in diameter. It persists for 7 to 10 days, and on fading shows superficial scaling and a persistent brownish pigmentation. The amount of toxin injected as advised by Schick is 1/50 M. L. D. for the guinea pig in .1 c.c. of normal saline solution. It is important to distinguish the true reaction from a pseudo-reaction, which is only found in a small percentage of older children and adults. The pseudo-reaction can be distinguished clinically, as it appears earlier, is more infiltrated, less sharply circumscribed and usually disappears in 3 to 4 days. It leaves only a faintly pigmented area, which soon becomes invisible. With this test Schick attempted to place on a more rational experimental basis some interesting clinical problems in connection with the prophylactic and therapeutic dosage and mode of administration of antitoxin. By making a test at regular intervals previous to the injection of antitoxin, he found that neutralization of toxin in contact with tissue cells was still possible up to a certain number of hours. This was demonstrated by the partial or complete suppression of the reaction. The efficiency of the injected antitoxin depended on the mode of administration and the size of the dose. The presence or absence of antitoxin in a case of suspected diphtheria was used as of value in diagnosis. They also used it in the diagnosis of clinically doubtful nasal diphtheria. With a purulent or sanious nasal discharge showing the Klebs-Loeffler bacillus it is difficult to decide whether the case is a carrier or a beginning diphtheria. A negative reaction excludes diphtheria, while a positive Schick reaction leaves the diagnosis of diphtheria still a probability. A case of tonsillitis, due to streptococci, which was also a carrier of diphtheria bacilli, would, by the use of the culture alone, be thought to have diphtheria and in danger of extension of the disease. A negative Schick reaction would indicate the case to be simply a carrier and in no danger from the effects of the diphtheria poison. Park and Zingher<sup>3</sup> in later experiments found that individuals who, before treatment with toxin-antitoxin, give a negative Schick reaction are immune probably for life and, therefore, it is not neces-

3. Park, W. H. and Zingher, A.: Dept. of Health, City of N. Y., Reprint Series No. 39, Jan., 1916.

sary to inject them, when exposed, either with antitoxin or toxin-antitoxin. Those who give a positive Schick reaction and are exposed to diphtheria and in immediate danger should receive either antitoxin alone or, if a longer protection is desired, both antitoxin and toxin-antitoxin. For the general prophylaxis against diphtheria in schools and communities, excluding immediate contacts, a mixture of toxin-antitoxin alone or toxin-antitoxin plus vaccine of killed diphtheria bacilli is recommended. The dose is 1 c.c. of toxin-antitoxin and 1,000,000,000 bacteria injected subcutaneously and repeated three times at intervals of 6 or 7 days. The early and late results of active immunization should however be determined with the Schick test. Early results are those obtained by the application of the test within 4 weeks, and late results from 4 months to 2 years after the immunizing doses.

The property of toxin-antitoxin mixtures to produce immunity in animals has long been known. Von Behring in 1912 made the first attempt to immunize children. In May 1913, Behring published the results obtained in human beings. Park, Zingher and Serota<sup>4</sup> attempted to immunize actively against diphtheria. They found that persons with natural antitoxin gave a ready response to active immunization, while those with no appreciable, natural antitoxin failed to do so in a considerable proportion of cases.

Stovall<sup>5</sup> considers the Schick test reliable, efficient, and available to any physician. The patients showing a positive reaction in 36 hours should be given 1000 units of antitoxin. It makes no difference if the patients exposed cannot be isolated, and it saves the expense of injecting all.

Ruh, Miller and Perkins<sup>6</sup> strongly recommend tonsillectomy in diphtheria carriers as being a safe procedure, a quicker release from quarantine, and, to the public, a greater assurance that the patient is no longer dangerous.

Rappaport<sup>7</sup> states that kaolin, when properly applied, by its absorptive power mechanically removes bacteria with which it comes in contact, and its application to the nose and throat helps to remove diphtheria bacilli and to shorten the period of quarantine after diphtheria. Removal of tonsils and adenoids is indicated when diphtheria bacilli persist unduly in spite of kaolin.

C. A. LANG.

4. Jour. A.M.A., Sept. 5, 1914, p. 859.

5. Jour. A.M.A., March 11, 1916, p. 804.

6. Jour. A.M.A., March 25, 1916, p. 941.

7. Jour. A.M.A., March 25, 1916, p. 943.

# ARCHIVES OF PEDIATRICS

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## SOCIETY REPORT

### THE AMERICAN PEDIATRIC SOCIETY.

*Thirty-Third Annual Meeting Held in Swampscott, Mass.,  
June 2, 3 and 4, 1921.\**

*The President, DR. JOHN HOWLAND, of Baltimore, in the Chair.*

### PROLONGED INTOLERANCE TO CARBOHYDRATES.

DR. JOHN HOWLAND, in his presidential address, said it was now generally appreciated that sugars initiated and perpetuated diarrhea and were capable of doing a great amount of harm. Many children with a prolonged sugar intolerance had a tendency to diarrhea even when taking woman's milk. It was apparently the sugar and not the fat that was responsible, as was suggested by a diet deficient in carbohydrates which was borne even though it might contain a considerable proportion of fat. The disturb-

\*Detailed report specially made for Archives of Pediatrics.

ance in those patients was usually attributed to something else than the peculiarity of the individual. A more important condition was the prolonged intolerance that developed after severe diarrhea, especially after numerous attacks of diarrhea. The first indication here was to reduce the sugar to its lowest limits in a food which furnished the other requirements for adequate nutrition. Nothing could compare with protein milk in this respect. It allowed the presence of fat, protein and salts with minimum of disturbing sugar and it furnished the substances necessary for the formation of insoluble soaps. Carbohydrates must be withheld for a long time. A polysaccharid, such as farina, was not only at times well borne but might even have a marked constipating effect. Young infants usually would not tolerate this. With older infants it might be strikingly successful. These forms of carbohydrate intolerance were confined almost entirely to the first 2 years. Another form, perhaps the most striking and certainly the most persistent, occurred in children of all ages. It was commonly known as chronic indigestion or as intestinal infantilism of Herter. Theories as to the causation of this condition were hard to substantiate. At present we might theorize but not prove. One might speak of the treatment with more assurance. It had been found that of all the elements of food carbohydrate was the one that must be rigorously excluded. The dietary treatment might be divided into three stages. First, that with protein milk alone. From experience with more than 30 such patients, it could be said that, more than any other food, this was likely to bring satisfactory results. It was preferable to buttermilk on account of its somewhat higher caloric value and especially because of its far lower sugar content. How long the protein milk stage should be continued depended upon the intestinal reaction and somewhat upon the age of the child but usually was a matter of days or a few weeks. It should be continued until the stools were firm, distention very slight, gas not in excess and appetite good. The diet in the second stage consisted of protein milk as a basis reinforced by almost pure protein foods. These might include curd without whey, scraped meat, certain forms of cheese, egg white and eventually whole egg. The duration of this stage was many months; it might be years. This was not an ideal



diet but it was an adequate diet. A child might take such a diet for a long time with nothing but benefit and with a continued gain in weight. With this diet there was enough sugar to guard against acidosis and no danger of lack of vitamins. Vitamine-A was supplied by the fat of protein milk, which was for this reason to be preferred to buttermilk. Vitamine-B was supplied by the whey of the buttermilk, and the antiscorbutic factor can be given in the form of orange juice or tomato juice. In the third stage, carbohydrates were added very gradually with most careful observation of the digestive capacity. Bread, cereal and potato were the last articles that could be allowed. The treatment was time-consuming but these patients well repaid the effort expended upon them. They did not remain invalids but became vigorous and strong. It might appear that all this was self-evident. It was. But numerous were the errors that were committed with these children, either from failure to understand the food element at fault, or from a fear of eliminating this almost entirely from the "diet." As with diabetes, a rational program must be instituted and a definite method of progress outlined. In endeavoring to explain this peculiar reaction to carbohydrates many difficulties were met. The first thought was of the possibility of disturbance of digestion or absorption. When tested for in children, ferments that affected carbohydrates always were found. There was the possibility that conditions were not proper for their action. Recent studies had shown that for ferments there was an optimum reaction in a rather narrow zone and that this reaction varied with each ferment. What was the reaction at different points in the intestine? It was long taught that the reaction of the small intestine, beyond the opening of the pancreatic duct, was alkaline. It now appeared that it was acid throughout all, or nearly all, its extent. It might well be that in many disturbances of the intestine it was the reaction and not the ferments that were at fault. It was also possible that ferments were present in a diminished quantity. There was no method available for determining a change in the amount of enzymes present and little assistance to be gained at present from the study of enzymes which might be the substances at fault with carbohydrate disturbances. With the new methods devised for attacking problems from this source, much

information, and that of most fundamental character, might be obtained. It was possible that absorption might be defective. The three factors concerned in absorption are osmotic pressure, so-called "Triebkraft" or specific absorbing capacity of intestinal wall, and lipoid solubility of some intestinal material. That osmotic suction played a part was indicated by the slower absorption of the more concentrated as compared with less concentrated solutions. But even with hypertonic solutions, fluid was absorbed together with sugar against the direction of osmotic flow. It was the specific absorbing capacity that makes absorption possible against the direction of osmotic flow, a truly remarkable phenomenon, and on the basis of present knowledge of physical chemistry, unexplainable. Delayed absorption would allow bacteria to attack sugar with production of much gas, to destroy some sugar and to convert some into irritating substances. All these possibilities existed and there might be factors operative outside the digestive tract. All this showed how unsatisfactory our knowledge was upon any single definite intestinal activity and with carbohydrates upon the 2 most fundamental, transformation and absorption. Until we have more information we cannot expect to understand the normal processes to say nothing of these abnormal ones that play so important a part in infancy and early childhood.

#### BLOOD STUDIES IN THE NEW-BORN.

DR. WILLIAM PALMER LUCAS, DR. BRADFORD FRENCH DEARING, DR. HAL R. HOOBLER, et al., of San Francisco, made this presentation in which they attempted to bring together the morphology, chemistry, coagulation and pigment metabolism into a combined study of the blood of the normal new-born infant. The blood was obtained from a few hours after birth to the fourteenth day postpartum. Most of the figures represented serial studies obtained on alternate days from the same baby. In this way 150 babies were studied. The hemoglobin was high at birth, the average being 117, and gradually decreased thereafter. The hemoglobin of the sinus blood tended to be higher than that of the peripheral blood. The red blood cells were high during the first week and then gradually decreased, corresponding closely with the hemoglobin estimations. The same leucocy-

tosis was observed as had been noticed by various authors, though this leucocytosis was by no means constant. The leucocytosis during the first week was definitely due to the polymorphonuclears. This continued to be so until the seventh day during which day the polymorphonuclears gradually declined, reaching the same level as the lymphocytes on this day. The lymphocytes, during the same period, gradually increased and were still increasing at the close of these observations on the twelfth day. There was slight increase in the transitional cells, which towards the end of the period of observations decreased slightly. The same was true of the eosinophiles. These counts in the sinus blood again showed a slight increase over those of the peripheral blood.

The platelet counts, during the first 8 days, corresponded very nearly to those of Dr. Mary E. Morse, who found immediately after birth a blood count which varied from 412,000 to 100,000. They did not find any counts, however, as low as the latter figure, their lowest figure being 195,000 on the eighth day; neither were the platelets reduced in cases in which the coagulation was prolonged, nor was there any difference in cases that were markedly jaundiced and those that were slightly or not at all jaundiced.

The estimations on non-protein nitrogen, urea, uric acid, creatinine, sugar and  $\text{CO}_2$  had been repeated. They were unable to find any values on the  $\text{CO}_2$  made on blood of the new-born. Except for the low estimations which were found for sugar during the first 4 or 5 days their findings correspond well with those of Sedgwick and others. Their only explanation for the low sugar finding was that the infants were breast fed and received no supplementary food except water. Graphic curves showed a very definite drop in the non-protein nitrogen, urea and creatinine during the first few days and a definite rise in the  $\text{CO}_2$  curve. The tables and curves showed very definitely that during this period there was a high body metabolism.

Forty-seven calcium determinations on 12 infants, ranging in age from one to 12 days, showed that the average calcium content of the plasma was higher in the new-born than in older children. There was a constancy of the plasma volumes throughout the series, each determination varying less than 1 mg. per

100 c.c. from the general average. Apparently in man the drop in plasma did not occur during the first 12 days of life. In general, the corpuscle values tended to decrease slightly during the first few days. On the other hand, there was a tendency for the whole blood values to increase.

In reference to the coagulation time, any method which used a puncture wound must of necessity have certain inherent errors. The method used in these estimations was to obtain blood from the longitudinal sinus with an all-glass Luer syringe, carefully sterilized. During the first 5 days, there was a definite prolongation of the coagulation time. This showed clearly that during these first few days there was a definite and fairly constant condition in the blood of the new-born which favored the so-called hemorrhagic conditions of the new-born. During the period of prolonged coagulation time, the serum bilirubin curve was also increased, but it did not seem to affect the coagulation time in cases of marked jaundice.

The prothrombin factor was investigated and it was proved that during the time when the coagulation time was prolonged, the prothrombin element was definitely diminished; after the fourth day the prothrombin apparently reached normal levels, though it might be delayed several days longer. The blood of the new-born did not show any defect in retractability of the clot and there was no fibrolysis. This was exactly the condition that existed in hemophilia. They felt confident therefore that the factor involved in the ordinary case of hemorrhage of the new-born was due to diminution in the prothrombin element which was mainly derived from platelets and the defect was essentially a qualitative one of the platelets.

So far they had been unable to show the presence of any urobilin in the stools of new-born infants during the first 12 days of life, nor had they been able to demonstrate urobilin in the stools of infants up to 10 weeks of age, although in older children it was easy to demonstrate its presence. Ninety cases were examined for bilirubin by a method which the writers proposed; of these, 72 showed a positive reaction. At present, they did not feel in a position to discuss what became of the red blood cells, but they felt that this method of testing bilirubin gave a

much better means than we had hitherto possessed of attacking this problem.

*Discussion.*—DR. ALFRED F. HESS, of New York, said that the most remarkable thing about this study was the prolonged coagulation time of the blood in these new-born infants. This would indicate that they had latent hemophilia. These figures made one wonder that we did not see hemorrhage in the new-born more often. As these were normal figures, the question came up as to what the figures would be in hemorrhage of the new-born.

DR. FRITZ B. TALBOT, of Boston, said the blood sugar studies were interesting compared with the respiratory quotient. The blood sugar was lowest at birth and rose on the third day and this was consistent with the respiratory quotient which went down and then on the third day began to rise. It showed that whatever sugar came into the world with the infant was used up quickly. These were very low figures compared with those of Folin.

DR. LUCAS said that as to the question Dr. Hess had raised, that of potential hemophilia, they had found a coagulation time up to 45 minutes without any bleeding at all. It was the same question that had come up in reference to hemophilia, namely, why the hemophiliac did not bleed all the time when the coagulation time was prolonged all the time. As to the sugar curves, they thought these very low and repeated the observations with the same results.

#### SOME OBSERVATIONS ON THE SO-CALLED INANITION FEVER OF THE NEW-BORN.

DR. CLIFFORD G. GRULEE and DR. B. E. BONAR, of Chicago, presented this paper which consisted of a study of 183 new-born infants with regard to transitory fever. They stated that for years it had been recognized that in a certain percentage of infants there occurred in the first few days of life a rise in temperature. This fever had not been accounted for satisfactorily. It offered an example of a febrile condition apparently simple in nature and it was thought that a careful clinical study of this condition might throw some light on the immediate factors that

caused rise in temperature. On tables were noted: (1) The weight for the first 5 days; (2) the percentage of greatest weight loss; (3) the highest daily temperature for 5 days; (4) the quantity of breast milk for 5 days; (5) the quantity of supplementary food for the first 5 days; (6) the quantity of water for 5 days; (7) the total foods taken for 5 days; (8) the estimated loss by vomiting; (9) the total number of stools for 5 days, divided into (a) meconium and (b) milk stools; (10) icterus, if present, and the day upon which it appeared. The cases were then divided into groups according to weight. For normal cases, the average weight loss was 6.2 per cent.; for 46 cases, with a temperature between  $99.2^{\circ}$  and  $100^{\circ}$ , the weight loss was 6.2 per cent.; for 16 cases, with a temperature between  $100.2^{\circ}$  and  $102^{\circ}$ , the average weight loss was 11.2 per cent. While at first glance this appeared to be significant, still, if one examined carefully the individual cases, it was found that among the cases with normal temperature the loss of weight was as great as 17.3 per cent., which was higher than in any case with fever. A careful examination of the tables failed to show any regular relationship between the quantity of fluid ingested and the occurrence of fever in any one of these groups; while there were cases here and there in which there seemed to be a relation between the fever and the food ingested, there were many cases in which the opposite was true. Neither did there appear to be any definite relationship between the percentage of weight loss and the temperature. They were therefore forced to the conclusion that the temperature rise in question was not regularly to be explained on the basis of dehydration. The explanation must therefore be sought on some other basis. The increased permeability of the intestinal mucosa for egg albumin during this period of life, as shown in a previous communication, more recently the confirmation of the finding of von Reuss in regard to the finding of indican in the new-born, and the fact that the intestinal canal within 24 hours after birth was invaded by bacteria as far as the pylorus, suggested that the temperature elevation at this time might be ascribed to the absorption of some protein products, bacterial or otherwise, from the intestine of the new-born. With the stimulation of digestion and the flow of gastric and intestinal juices produced by the taking in of foods,

the meconium, which before contained small quantities of fluid and therefore a humidity too low for the growth of bacteria, was invaded by bacteria. The meconium consisted almost entirely of protein material, the destruction of which would most readily account for the presence of indican in such a large proportion of urines from new-born infants. With the introduction of breast milk, the putrefactive processes in the intestines were reduced and there was a fall in temperature. That the condition did not give rise to more serious symptoms than were present might be explained by the rapid change of condition within the intestinal canal.

*Discussion.*—DR. ROWLAND B. FREEMAN, of New York, stated that this was a very valuable contribution. He was disappointed with the results. It had seemed that dehydration did cause fever and that this would explain so-called inanition fever.

DR. GRULEE said he shared Dr. Freeman's disappointment. He had hoped to be able to find that the fever in these cases was due to desiccation, but could find no such evidence in this investigation.

#### A CLINICAL REPORT OF SIMPLE METHODS IN THE CARE OF PREMATURE BABIES.

DR. WALTER LESTER CARR, of New York, presented this paper which was based on observations made at the Manhattan Maternity Hospital and Dispensary and the Woman's Hospital. The incubator room at the Manhattan Maternity was 6½ feet by 7 feet with a ceiling 12 feet high and a single door opening from the main nursery. The air intake was from the window by means of a flue, 9 by 2 inches, and the air was carried back of a radiator. The room temperature was kept at 80°.

The incubator was an aluminum tray with a rounded top, 24 inches in length and 12 inches in width, with a hood, 12 inches high, which did not extend the entire length of the tray but allowed the baby's head to be out of the hood. Over this open end there was a curtain to protect the baby's head and body. The other end of the incubator was closed and in it was a door, 4 by 6 inches. In the top of the incubator were 3 openings for electric lights placed on elbows so as not to interfere with the clothing. One 15 Watt light would give an incubator

a temperature of 76°, two, a temperature of 88° and three, a temperature of 96° in three-quarters of an hour. A thermometer was placed inside the incubator in a place to be observed by the nurse. A moderate heat was better than a constant high temperature. At the time of birth premature babies were anointed with oil but not bathed, the eyes were treated and an umbilical dressing applied. Diapers of cheese cloth and cotton were used.

The more premature a baby the more feeble was its digestion. Breast milk should be given if it could be obtained; it should be drawn from the mother or wet nurse, diluted with equal parts of 5 per cent. milk sugar solution and fed with a medicine dropper or a Breck feeder. Premature babies did not bear high fat and this might give trouble even with mother's milk. If cows' milk had to be given, it should be boiled and diluted as ordered. Water must be given freely. Feeding intervals should be about 2 hours apart and should not exceed 1 or 2 drams each time. Whenever possible, feeding should be done without removing the baby from the incubator. Cane sugar was given to babies who had a persistent low temperature and it apparently helped heat production. Whatever methods of feeding were used it was essential to realize that the caloric requirements were high. Gavage, lavage and hyperdermoclysis were sometimes employed. The administration of fluid through the longitudinal sinus was not a safe means of combating loss of weight as the sinus was small and pliable and other methods were less dangerous in babies under 4 pounds.

Thirty premature babies were observed at the Manhattan Maternity which was less than half of one per cent. of the number of confinements. The average weight of the babies on leaving the hospital was four pounds and three-quarter ounces. The routine was to keep the babies in the hospital until the weight approximated 4 pounds. The average time the incubator babies were kept in the hospital was 36.8 days. Premature babies were prone to be rachitic. Three of five who were given dryco, showed rickets. One of these had rachitis and double keratitis, and 2 had marked rickets.

*Discussion.*—DR. HENRY DWIGHT CHAPIN, of New York, said that in the care of premature babies two things were of



importance, the temperature of the incubator and the food, and of these the food was the more important. In his experience with several hundred incubator babies, he had never been able to raise one without breast milk. In the exhibitions of incubator babies given for pay they always gave the babies breast milk and placed less importance on the temperature.

DR. ISAAC A. ABT, of Chicago, said he had in mind just what Dr. Chapin had said with this addition, that ordinarily the temperature of the incubators was too high. These babies did not need a temperature of 80°; 75° or a little over was enough. If the incubator was over-heated, the baby did poorly.

DR. L. E. LA FÉTRA, of New York, said that in his experience a temperature of about 76° was best. If the temperature was higher, the air became too dry and this caused the baby's lips to crack and exposed the child to infection. Feeding was very important and breast milk was desirable, but where it could not be obtained a modified milk, which had been peptonized, might be used with success.

DR. FRITZ B. TALBOT, of Boston, said that temperature was almost equally as important as food. It did not make so much difference what the room temperature was, the important point was whether the baby's temperature was normal. The basal metabolism figures were important. A premature baby fell into the class of cold-blooded animals. The temperature was dependent upon the rate of metabolism in these babies. When the temperature was subnormal, the basal metabolism was subnormal. The babies with subnormal temperatures did not gain until the temperature became normal, and when they began to gain the metabolism went up.

DR. FREDERICK H. BARTLETT, of New York, emphasized the method of feeding. Not only the temperature and the kind of food were of importance, but the way in which the baby was fed often made a difference whether it remained stationary or gained in weight. It might be necessary to use a Breck feeder or gavage. This was worth while insisting upon. The introduction of fluid would also help to establish a gain in weight and to prevent exhaustion.

DR. J. P. GROZER GRIFFITH, of Philadelphia, described an asbestos incubator which they were using. The baby was on a

mattress placed on an asbestos tray which was over the lights. This worked well in the absence of a warm room. These babies required considerable heat. As soon as the temperature went down the babies did badly. The same thing was true of babies with malnutrition.

#### MALNUTRITION IN CHILDREN OF THE WELL-TO-DO. A REVIEW OF OUR CASE HISTORIES.

DR. CHARLES GILMORE KERLEY, DR. EDWARD J. LORENZE, JR., and DR. ROGER DU BOSE, of New York, presented this communication, in which they described a type of cases of malnutrition which was referred by the family physician or brought independently, because the child remained persistently an inferior individual from a physical standpoint, sufficiently so to be a cause of anxiety. In the majority of these cases, 2 features stood out prominently, namely, deficient food intake or imperfect digestion though the caloric intake was not necessarily below requirements. It was found that these cases fell into groups. First, there were those in which there was a maladjustment of the different food elements. Usually butter, cream and 4 per cent. milk fat had been crowded. From the caloric standpoint the children had been fed above their requirements on a non-growing diet. The essential foods, meats, cereals, vegetables and fruits were taken indifferently. In the management of these children, the fact must be recognized that there must be a healthy desire for food and this was created by the withdrawal of fats and sugars in large measure. Three meals were given daily at 5-hour intervals, and nothing but water was allowed between meals. A low fat and sugar diet was given and skimmed milk, only, 16 to 20 ounces, was allowed. In a second group, hyperacidity of the stomach juices caused defective food intake and malnutrition largely through the production of a poor appetite. The chief symptom of hyperacidity was a lack of desire for food. In cases of long standing nausea and vomiting was a prominent symptom. The pain and discomfort was greatest before meals.

Gastric analyses were made in 51 cases, between the ages of 2 and 8 years. The test meals consisted of a slice of white bread and a cup of weak tea. A total acidity ranging from 38 to 138 was found. They had come to look upon a normal acidity as

ranging between 30 and 40. Among the etiological factors in this group, candy and ice cream, irregularity in meal hours, and faulty feeding figured prominently. It was with the rarest exception that the history of an hyperacidity patient did not contain the statement that orange juice was given on an empty stomach before breakfast. This type of patients usually responded to dietetic treatment. Three meals suitable for the age were given and usually nothing between meals but water. Extremes as regards temperature of foods and drinks were avoided. Condiments, candy, pastry and raw fruits were excluded. A powder consisting of bicarbonate of soda, 2 gr.; bismuth subnitrate, 2 gr.; and magnesium carbonate was given 15 minutes before meals. A daily evacuation of the bowels was arranged for.

A third group of cases were those in which defective intestinal mechanics delayed stomach emptying. Elsewhere attention has been called to the fact that one usually found defective food intake and poor appetite in those who showed a stomach residue after 4½ hours. In order for a child to have a normal desire for food there must be an interdigestive period of one hour. Retention was often due to pylorospasm occasioned by an anomaly or lesion lower down in the intestinal tract. In this group they had demonstrated ptosis, angulation, dilatation, and saccululation. It was quite obviously impossible to outline a plan of management that would apply to all cases. One patient with massive dilatation of the sigmoid, the result of adhesions, was successfully operated upon by Dr. William A. Downes. In the ptosis cases, a snugly-fitting abdominal belt with a pad or projecting shelf was worn for months. In those, which had a dilated cecum, massage and liquid petrolatum had been successfully employed. In 3 cases, stretching of the sphincter muscle was sufficient to cure a persistent rectal constipation. A fourth group, comparatively small, contained the greatest number of failures. These were the underweight over-active anemic, physically retarded, precocious children that one saw only occasionally before the third year. For this type of child, Dr. Kerley said he had borrowed from the stock farmer the term "poor individual," and he marked them 50, 60 or 70 per cent. individuals.

In conversation with Professor Lafayette Mendel he had

suggested that the deficiency might relate to defective vitamine intake or defective vitamine utilization. A supply of dried brewers' yeast was obtained and kept in stock by a nearby apothecary. This they had used in 125 cases with varying degrees of malnutrition, not all belonging to the latter group. A careful analysis of the histories failed to show that there was any benefit from the administration of the yeast. What favorable results they had had followed a plan of rest cure and a curtailment of activities, with school attendance delayed a year or two. Endocrine therapy, with the exception of the use of thyroid in the cretin, had been unsatisfactory. They had used this kind of therapy freely and had failed to demonstrate its utility. Where there was incapacity for the digestion of certain foods, it was usually the fats or carbohydrates, and this was readily corrected. A large majority of our cases of faulty development related to food intake and utilization, and for success in their management we must supply the requirements.

*Discussion.*—DR. L. EMMETT HOLT, of New York, said it seemed absurd to discuss in a society like this the abuse of over-feeding children, and yet he was glad Dr. Kerley had brought it up, since they still saw it practiced not only by the general practitioner but by the pediatricist. Many children were brought to him because they would not eat. Often children, 6 or 7 years of age, were brought and the mother said the child had never been hungry. The mother said it took 1 or 2 hours to feed the child and the food had to be spooned in; the children coaxed, bribed and whipped to get them to eat. The mother had the idea that if a child would not eat it must be forced to do so, and the result of this course was that the child vomited and became anemic and undernourished. The absurdity of over-feeding would have to be brought home not only to the general practitioner, but to every one charged with the care of children, and even to the pediatricist. We still had a great deal to learn as to the amount of food a child could utilize. When a child refused to eat the food set before him, it should be taken away and nothing given him until the next meal-time.

DR. HENRY DWIGHT CHAPIN, of New York, called attention to the interesting point that Dr. Kerley was one of the first to report results as to the use of yeast. It was time something

was said about it. The newspapers were advertising yeast and saying "A yeast cake a day will keep the doctor away." He believed that if this society said something on this subject it would have an effect on these advertisers and would do some good.

DR. LANGLEY PORTER, of San Francisco, spoke of fatigue as a factor in these forms of malnutrition. If one put those children to bed and saw that they rested they often improved very promptly. Another point of importance was the psychology of these children. A nurse skilled in the psychology of childhood could often bring about astonishing changes in a child of this kind without a change of diet.

#### SOME RESULTS OF STUDIES OF ANAEROBIC BACTERIA IN THE INFANT INTESTINE.

DR. LANGLEY PORTER, of San Francisco, recalled that at the 1919 meeting the writers reported work done in the attempt to relate certain chemical intoxicative manifestations to be met with during infancy and childhood to variations in the flora of the intestines. During this work, evidence was encountered which led to the conclusion that some attacks of flatulency with abdominal distention were brought about by a preponderance of *B. Welchii* in the intestines of the patient. An effective therapeutic plan for dealing with this condition was worked out and reported at the 1920 meeting. During the work they came upon certain refractory cases; it seemed possible that an intensive study of anaerobes to be found in the gut might aid in dealing with future cases of a like nature. In this study of anaerobes they had availed themselves of the methods developed by Dr. Hilda Heller of the Bacteriological Department of the Hooper Foundation. Dilution shakes in deep agar were employed exclusively for isolation. The attempt was made to test the influence of age, of varied diets, of the concomitant aerobic flora, and of abnormal intestinal conditions on the presence of individual anaerobes or groups of anaerobes, and evidence was sought which might relate anaerobes present in the gut of the infants to clinical pictures of digestive or metabolic disturbances. At present, apart from attacks of acute flatulence brought about by certain entrances of *B. Welchii*, there was no evidence sufficient

to make such a relation even probable. The work indicated that the anaerobic flora of the infant's stools were relatively simple, probably made up of a few types, the most prominent being *B. Welchii*, *B. bifermentans*, *B. sporogenes*, and a terminal end-sporulating organism of the tetanus amorphous group. Although the flora appeared to be ample, it was hard to get a complete picture because of the difficulties of technique and of identification. After a pure culture had been obtained, it was not always easy to identify it.

In working out the anaerobic flora, one could not expect to get results under 72 hours, as in the case of the aerobic flora, because the process was long and tedious. After describing the technique, the essayist stated that 17 normal infants' stools were studied. In so far as anaerobes were concerned, 13 stools were negative and 4 showed the presence of *B. bifermentans*. This organism made its appearance on the fourth or fifth day. The results indicated that probably the first anaerobe to develop in the infantile intestinal tract was *B. bifermentans*. An experiment was carried out to determine the effect of a change of food and supplemental feeding on the anaerobic flora. One group of infants was kept on breast milk, using 3 supplements, (1) sterile water; (2) Ringer's solution; (3) saccharine water; and another group was kept on modified cows' milk, also using the 3 supplements. The aerobic flora was also studied to observe any change in the general type of organism present. Since there were fewer anaerobes in the infants' stool, it was not possible to note any effect of different foods or supplements. There was a change noted in the aerobic flora, which had been noticed before by Echener. The stools of the babies fed on breast milk showed the typical aciduric *B. bifidus* flora, while those fed on modified milk showed a flora of a more complex nature, approximating a semi-putrefactive flora. The three supplements had no noticeable effect on the aerobic or anaerobic flora of either group of babies. From clinical experience there might be a relationship between the intestinal flora of the mother and that of the child with special reference to the presence of *B. Welchii*. The anaerobic and aerobic flora were studied in each case with the following results: Cultures were obtained from the mother and child on the same day and repeated several times in each case. There

seemed to be no relation between the flora of the mother and that of the child. Probably the child was not infected by the mother.

While the insufficient number of cases studied has thrown no new light to help elucidate chemical problems brought about by alterations in digestion and metabolism, certain digestive observations were made. For example, while *B. Welchii* had been found in all types of stools, normal, putrefactive and sacchrolytic, there was a very great difference in the numbers of this organism to be found in each case and it was possible that further studies might show these quantitative differences to have some chemical significance. The symbiotic relationship of aerobe to anaerobe was one of interest. It might be that certain symbioses promoted the growth of anaerobes whose by-products are harmful. In this connection, the work of McIntosh on the toxicity of his unidentified VIII, closely allied or similar to *B. bifermentans*, was most suggestive. The high toxicity of this organism and the ease with which it might be overlooked lead one to wonder if further investigation along this line might not throw light upon some of the obscure diseases that heretofore we had classified as intestinal intoxication.

#### PNEUMOCOCCUS PERITONITIS IN INFANCY AND CHILDHOOD.

DR. HENRY HEIMAN, of New York, presented an analysis of cases of peritonitis admitted to Mt. Sinai Hospital within the past 8 months. He reviewed the literature of the subject and stated that pneumococcus peritonitis was a rare disease. During 5 years, 125 cases of genuine peritonitis were admitted to the children's wards at Mt. Sinai and the pneumococcus was present in but 15. The disease was more prevalent under 15 years of age. The majority of writers had noted a high incidence among females. In this series, 13 were females and 2 males. The appearance of the peritoneal cavity was pathognomonic. There was a diffuse inflammatory process characterized by the deposit of a large quantity of fibrin on the viscera, often matting together loops of intestine. The free pus was of greenish yellow color, odorless and containing flakes of fibrin. In some of the cases the process tended to localize adhesions developed and abscesses

formed usually in the umbilical region. In 9 cases in this series, the type of disease was determined. It was type I in 5 cases; type II in but one case; type III in no cases; and type IV in 3 cases. In 5 out of 8 cases, blood cultures were positive for pneumococcus.

A high leucocytosis was characteristic in these cases. The course of the disease was divided into 3 phases: First, sudden onset with severe abdominal pain, rise in temperature, rapid pulse, and prostration. Pain usually generalized. Most marked in right lower quadrant. The degree of abdominal rigidity was not as marked as in other forms of peritonitis. Signs of fluid were not often elicited. In the second phase, the condition improved; the third phase was characterized by the presence of a circumscribed mass in the abdomen, usually in the umbilical or hypogastric region. The temperature rise became intermittent and the patient gradually lost strength from the toxemia. Death ensued from toxemia, or recovery might follow spontaneous rupture through the abdominal wall, or operation. He did not believe with Mechant that the diffuse and localized forms of the disease represented 2 entities caused by different strains of the organism.

From acute appendicitis the diagnosis was most difficult. An overwhelming toxemia giving rise to early prostration, the anxious expression, gray color and sunken eyes are diagnostic of pneumococcus infection. During the past 6 months, they had employed a method of diagnosis which had given invariably good results. Dr. Howard Lilienthal suggested abdominal aspiration in all suspicious cases. This procedure was used in 4 of our recent cases and the diagnosis of pneumococcus peritonitis was made in all of them before operation. An ordinary hypodermic syringe was used with the finest calibered needle. The point of preference for puncture was one inch below and one inch to the left of the umbilicus which would penetrate an area over small intestines only. They were able to secure sufficient pus for smear examinations and cultures in all cases. The prognosis depended upon the localization of the inflammatory process and the development of other organs. Whipple had reported good results following the injection of antipneumococcic serum. He had employed it intensively in 4 cases without avail. In those



cases that presented localized collections of pus, all writers agreed that surgical intervention should be employed. There was a difference of opinion with regard to the correct procedure in the acute diffuse stage of the disease. They believed the best treatment was to give an abundance of fluid by hypodermoclysis and proctoclysis, and to keep the patient under the influence of opium during the acute onset of the diffuse process. If the toxemia tended to lessen, it was advisable to wait for abscess formation before opening the abdomen. If, however, under supportive treatment no signs of improvement appeared, it was best to resort to surgery.

*Discussion.*—DR. OSCAR M. SCHLOSS, of New York, mentioned that in puzzling cases in which there were no symptoms pointing to peritoneal infection they had found that it was sometimes possible to get fluid with a capillary needle when by aspiration they could get none. The needle was so constructed that it could not approach beyond the trocar except for a very small distance.

DR. L. EMMETT HOLT, of New York, called attention to one type of pneumococcus peritonitis in which the peritonitis was a part of the general pneumonitis, in which one found a pericarditis and a peritonitis. Frequently it gave no symptoms and was found only at autopsy. The diagnosis was almost impossible. The test Dr. Schloss spoke of might be very useful. Dr. Gibson had recently written a paper in which he had recorded himself as unqualifiedly in favor of operation in pneumococcus peritonitis, and his statistics showed a large percentage of recoveries. Evidently there was a difference of opinion on this point, and also as to whether the peritonitis was first generalized and then became localized or whether it was first localized and then became generalized. There was a question whether these children should be subjected to operation; he did not think this question had been settled.

DR. ISAAC A. ABT, of Chicago, stated that he had seen quite a number of these cases. They usually ran a short and malignant course and were difficult to diagnose from appendicitis or ordinary peritonitis. A peculiar condition might occur during the course of the disease. The patient started with a severe stormy onset. After 2 or 3 days of high fever and great tox-

emia, the patient lapsed into a calm semi-comatose condition which reminded one of the condition seen when the appendix had ruptured. This was the condition which the surgeons called a "deceptive calm." After this the patient went rapidly downward and died. It seemed to him that even if one made an aspiration there would be some difficulty in telling whether one was dealing with a general peritonitis or a ruptured appendix. It seemed to him that exploratory operation might be justified and then one would know definitely whether or not an appendectomy were justified.

DR. CHARLES GILMORE KERLEY, of New York, said he had seen quite a number of cases of pneumococcus peritonitis, all of the fulminating type. In one instance the child developed a paralytic ileus and died.

DR. J. P. CROZER GRIFFITH, of Philadelphia, called attention to the difficulty in the early diagnosis of telling whether one was dealing with a true abdominal pain or a pain referred from the pleura. A referred pain might lead to the mistaken diagnosis of peritonitis. It seemed to him that it was better to take a chance until one was certain that the trouble was in the abdomen rather than to operate when it was unnecessary. He had seen instances in which early operation was performed and the patient died.

#### SOME REMARKS ON THE ELEMENTS OF DIET IN INFANCY, WITH SPECIAL REFERENCE TO THE EMPLOYMENT OF THE CZERNY AND KLEINSCHMIDT BUTTER-FLOUR MIXTURE.

DR. J. P. CROZER GRIFFITH, of Philadelphia, stated that Czerny and Kleinschmidt spoke of the composition of human milk and suggested that there was something in Nature which demands for the infant the relative proportions of fat, protein, and carbohydrates which existed in the milk the human breast supplied, and that it was not a matter of indifference, as many assumed whether or not the fat of the food was largely or entirely replaced by carbohydrates. The thought had long been present with the doctors that the giving of high protein per-

centages to normal infants was not a matter of indifference and that even the use of such food in many cases of digestive disturbance might be harmful rather than beneficial. There was also the question whether the substitution of fat by large percentages of carbohydrates, useful as it was in many cases, was one which was to be persisted in as entirely satisfactory after health had been regained. Their conviction had long been that a relationship in the diet closer in some respects to the proportion seen in human milk was eminently desirable. Czerny and Kleinschmidt, in a somewhat empirical but very successful manner, devised a food which permitted the employment of a high fat percentage in combination with a percentage of carbohydrates also high, but with the protein reduced to approximately that of human milk. They insisted upon the great importance of having the ratio of carbohydrate and fat a fixed one. As soon as this relationship was altered, the results were not so good. They believed that the results were to be ascribed in part to the driving off of the volatile fatty acids from the milk fat; in part to the admixture of an amount of flour equaling that of the fat; in part to chemical alteration of the flour produced by the browning which occurred during the preparation, and in part to the low protein percentage, the last being particularly important in weakly young infants. The proportions recommended by them consisted of 7 grams of butter, 7 grams of flour, 5 grams of sugar and 100 grams of water, to be mixed with varying amounts of milk according to the age of the patient. These figures might be rounded off to say 20 grams of butter, 20 grams of flour, 15 grams of sugar, and 300 grams of water, but the relationship of butter to flour must remain unchanged. In preparation 20 grams of butter were placed in a pan and heated over a gentle fire until foaming took place and until any odor of volatile fatty acids had disappeared. This required 5 to 8 minutes; 20 grams of fine wheat flour were then added. The whole boiled, rubbed through a fine sieve, and then mixed with the desired amount of previously boiled, cooled milk and the whole kept cool until needed. For children under 3000 grams in weight,  $\frac{1}{3}$  milk was added to  $\frac{2}{3}$  butter-flour mixture. For those 3000 grams or over,  $\frac{2}{5}$  of milk and  $\frac{3}{5}$  of butter-flour mixture were employed. Not

more than 200 grams per kilo body weight (about 3 fluid ounces per pound) should be given daily and usually smaller amounts than this were required owing to the high caloric value of the food. At the time of this report, 40 infants of 1 to 6 years had been fed in this way. Twenty-one had a weight of 3000 grams or less. The results were surprisingly good and the gain in weight and length excellent. There were no meteorisms, the stools were yellow and salve like, usually acid, and numbered 1 to 3 daily; sometimes 3 or 4 yet without harmful effect. No previous existing disposition to vomit was increased. Those that had not vomited earlier showed no tendency to begin. Gain in weight did not always begin at once, but when it did, went on with rapidity and without interruption. Children fed by this method resembled healthy breast fed children. The improvement in general appearance and condition was striking, particularly in development of fat in the lower part of body. Naturally not all infants did well. Results were particularly fine in weakly and premature infants, weighing less than 3000 grams. The results of Czerny and Kleinschmidt's experiments had been confirmed by Berend, Rutschel, Ochsenius, Stolte and others. The only unfavorable report is that of Rosa Lange who employed the food in 34 infants. While admitting the good results of others her own were not very good, there being more failures than successes owing probably to certain modifications of the Czerny-Kleinschmidt mixture and the fact that the clinical material was not satisfactory.

#### PERSONAL EXPERIENCES IN FEEDING INFANTS WITH THE CZERNY AND KLEINSCHMIDT BUTTER-FLOUR MIXTURE.

DR. A. GRAEME MITCHELL, of Philadelphia, reported their experience with the butter-flour mixture in 32 infants with the proportions given by Czerny and Kleinschmidt. Emphasis should be laid upon the necessity of following closely this method. For convenience they had estimated the amounts in tablespoonfuls. Thus it was sufficiently accurate to use 2 level tablespoonfuls of melted butter,  $2\frac{1}{2}$  level tablespoonfuls of flour,  $1\frac{1}{2}$  level tablespoonfuls of sugar to 10 fluid ounces of water. In whatever way the mixture was modified, the amounts of

butter and flour remained equal. In certain cases they had found it an advantage to reduce the amounts of butter and flour to less than 20 grams each to 300 c.c. of water.

In some cases the sugar should be decreased in amount or omitted entirely. Again, 1 to 3 feedings of butter-flour mixture a day were sometimes given as substitutes for the ordinary cows' milk mixtures which constituted the other feedings, and they had occasionally alternated it with breast feedings, as had been successfully done by others. It was quite simple to manipulate the percentages of fat, carbohydrates and protein in this food as the indications arose, always, however, maintaining the fixed relation of the butter to the flour. Based upon the analysis of Dr. Leon Jones of the Pepper Medical Laboratory of the University of Pennsylvania, one fluid ounce of stock solution might be said to represent 26.6 calories. The mixture containing  $\frac{2}{3}$  of the stock solution and 1-3 milk might be said to represent fat 4.6 per cent., carbohydrate, 8.2 per cent.; protein, 1.5 per cent. with a caloric value of 24.6 to the fluid ounce. Dr. Jones found that the fat of the stock solution after cooking consisted entirely of neutral fat and that no trace of fatty acids were discoverable. Whatever might be the cause of the good results produced by the butter-flour mixture, and whatever the relationship which the volatile acids might bear to this, it was at least certain that the results were good, and that these volatile fatty acids were removed.

The 32 cases in this series were for the most part those who had not seemed to thrive when fed on the more commonly employed simpler modifications of cows' milk. The condition was variously diagnosed as gastrointestinal indigestion, malnutrition, disturbance of balance, dyspepsia, depending upon nomenclature adopted and severity of symptoms. This mixture, like other foods, had its indications and counter-indications, and success in feeding depended upon proper selection of cases. The most severe forms of malnutrition, where the tolerance for any sort of food was low, might grow decidedly worse when butter-flour mixture was used. The food should therefore be given cautiously, if at all, to infants suffering from infantile atrophy (athreptic decomposition). Other conditions that might not be expected to respond favorably, nevertheless did so in certain

instances. Among these were certain cases of eczema and certain instances of gastrointestinal indigestion in which vomiting was a marked feature. They found that it was the infant whose low body weight was due to failure to properly metabolize sufficient cows' milk fat who responded most favorably to the Czerny-Kleinschmidt food. In spite of high fat content of butter-flour mixture, vomiting seldom occurred. Of 32 cases, only 2 had vomiting follow as a marked symptom. The stools were rather characteristic light yellow resembling a breast fed baby's stool; odor not offensive but somewhat aromatic; starch was invariably found. Mucus was seldom present; the stools were acid in reaction and varied from 1 to 3 in 24 hours. The gain in weight in infants who thrived upon butter-flour food was usually satisfactory and often wonderful and in their experience was shown quite promptly. Some gained weight so rapidly that it could only be explained on theory of water retention. Thus one baby gained 7 ounces the first night and 20 ounces in 6 days. The majority received the treatment for a month or longer. The stopping was usually done because progress was so excellent that it appeared time to send the infant to its home. The food was not difficult for the average mother to prepare. The amount of the mixture fed depended upon the age and weight of the child. Czerny and Kleinschmidt recommended 120 to 200 grams of food daily for each kilogram ( $1\frac{3}{4}$  to 3 fluid ounces per pound) 75-90 calories per pound of body weight per day in most of these cases. In most of the cases, sweating was present and as a consequence a condition developed spoken of as "butter-flour rash." The removal of a baby from butter-flour mixture was not a procedure to be accomplished quickly. Of the 32 infants fed on butter-flour mixture, 23 responded favorably by gain in weight and improvement in general condition. Digestion was good, vigor of tissues increased and maximum of amount of sleep was obtained. In analyzing histories of 9 infants that did not improve on butter-flour mixtures, in 7 the type of feeding was not responsible for failure. The 2 great lessons which the study taught were (1) that when fed with butter-flour infants might tolerate fat in a manner which could be accomplished probably by no other means yet known to us; and (2) that the truly remarkable results which often

followed were a strong proof of the great need which the infant's anatomy possessed for a food containing a sufficiently large amount of fat.

*Discussion.*—DR. CHARLES GILMORE KERLEY, of New York, said it appeared from the paper that this method had been very successful, and, if so, we should follow it. However, it was quite an involved proposition to put into the average family, and he did not see the necessity of following so many new and strange gods. Rotch had established the percentage method of feeding, and if one was having trouble with a difficult feeding case, he could write a prescription with the exact amounts of the various food elements he desired and the Walker-Gordon Company would put it up. It seemed to him we were striving unnecessarily for new procedures. Too many proprietary preparations and too much dryco was being used by men too lazy to study up the suitable formula for the child. It would be well to recall some of the things they had been taught some years ago and had forgotten.

DR. OSCAR M. SCHLOSS, of New York, stated that they had used the butter-flour mixture and had had the identical experience reported by Dr. Griffith and Dr. Mitchell. He thought that many babies did better on this mixture than when fed according to routine methods.

DR. HENRY DWIGHT CHAPIN, of New York, said there might be danger in getting things too simple. It might be possible to cut off the fats too much. A few years ago they were feeding all fats; now it was low fats or no fats. He thought the reason for this was the custom of estimating the caloric food requirements. It should be remembered that the different food elements were not interchangeable and particularly in early life. These papers were valuable because they showed how, in a certain class of cases, to keep the fats high.

DR. L. EMMETT HOLT, of New York, expressed the opinion that the protein content of the butter-flour mixture was too low for a long continued diet. The formulas of Rotch were based on the 3-6-1 ratio and after physicians used this ratio for a time they found that it was unsuccessful. They came to believe it was because of the high fat content, but he believed that, as with condensed milk, it was the low protein rather than the high fat

that accounted for the failure. He thought these dry milk preparations had a too low protein content. A food of this kind could not be used as a permanent food, but only to induce an initial gain, and then one should give a more rational formula as soon as possible.

DR. ALFRED F. HESS, of New York, stated that the diets upon which the babies in the Hebrew Infant Asylum did best were the Schloss milk, made of 160 c.c. of cream and 160 c.c. of milk to the liter, to which was added a certain amount of flour and sugar. It was similar to this mixture except that the fatty acids were not driven off. On that diet the children not only thrived but the texture of the skin and muscles was better than in the average bottle fed baby. This seemed to occur in spite of the fact that it contained fatty acids.

DR. J. CLAXTON GITTINGS, of Philadelphia, stated that he had had babies gain in weight with this method of feeding. He emphasized the fact that the butter-flour stock did not represent the total protein content but only the protein before milk was added.

DR. J. P. CROZER GRIFFITH, of Philadelphia, said that 25 men had used the butter-flour feeding and admitted that it gave surprisingly good results. The food was meant not for temporary but for permanent use.

DR. MITCHELL, in closing the discussion, said he wished to point out that this was in reality a percentage method of feeding. They always knew the percentages of the various elements in the mixture. It was simply a way to get the infant to take more fat. It was simply a method that helped these infants that did not get along well on cows' milk, and it might be true that it could be used indefinitely.

#### THE USE OF THICK CEREAL MIXTURES IN DIFFICULT FEEDING CASES.

DR. HENRY DWIGHT CHAPIN, of New York, stated that during the past few years a number of observers had reported striking results from the use of thick cereals in a number of abnormal conditions that might occur during early infancy. The observations reported in this paper were made on 20 infants with obstinate indigestion which had resulted in distinct malnu-



trition and pointed to the hopeless marasmus that finally resisted all aid. These were infants being cared for and prepared for adoption at the Alice Chapin Adoption Nursery. Some of these infants were exceedingly difficult to feed and any form of food that would check wasting until the infant had had time to adjust itself to a normal food was worthy of trial. As many of these nursery infants did not increase in weight it was decided to try cereal feedings in selected cases. Three mixtures were employed prepared as follows: The first was composed of 4 ounces from one quart of milk, 2 ounces of skimmed milk, 7 ounces of water and 3 level tablespoonfuls of farina with one level tablespoonful of granulated sugar. The babies were fed three ounces every four hours, formula and water alternately. The mixture was boiled one-half hour. The second formula was similar to this one except that it called for 15 ounces of skimmed milk and 6 ounces of water, and the baby was fed  $3\frac{1}{2}$  ounces every 4 hours, and water every four hours alternating. The third formula called for 4 ounces of top milk from a quart of milk, 28 ounces of skimmed milk, 9 ounces of water,  $4\frac{1}{2}$  level tablespoonfuls of farina, one level tablespoonful of granulated sugar and one level tablespoonful of malt sugar. Four to 6 ounces were fed every 4 hours, and water every 4 hours alternating. When vomiting was an important feature, the thick cereal mixtures did better and they were always tried first with a spoon. They might be given by the bottle by enlarging the hole in the rubber nipple. The effects of this feeding were occasionally uncertain, usually good, and sometimes remarkable. Laboratory analyses of the stools showed the percentage utilization of carbohydrates was practically equal to that of normal children and adults.

*Discussion.*—DR. CHARLES HENDEE SMITH, of New York, stated that the babies at Bellevue Hospital were put on thick cereal gruels by the internes' orders, and many children retained these gruels when they could keep nothing else down. They had a formula for which he thought Dr. LaFètra was responsible which called for 1 tablespoonful of farina to 5 or 6 ounces of milk and water. It was practically the same as the formula Dr. Chapin had given.

DR. HENRY HEIMAN, of New York, said he thought they

ought to welcome any new mixture that would feed 10 to 15 per cent. of difficult feeding cases. All babies, however, could not take these foods. He thought they all recognized that they had to adapt the food to the baby and not the baby to the food. It was their duty to try all these methods, and thick cereal mixtures were useful in some cases.

DR. J. P. CROZER GRIFFITH, of Philadelphia, stated that some babies did surprisingly well on these thick cereal mixtures. They had a very capable nurse who succeeded in getting the babies to take these mixtures by taking the rubber one-half of a hygeia bottle and with a spoon pushing the cereal through so that the baby sucked it.

DR. ROWLAND G. FREEMAN, of New York, said these thick cereal mixtures were most successful for vomiting babies. He had used them with great success and thought it strange that more physicians did not prescribe them. When they saw babies growing atrophic they used these thick cereal mixtures. They had used it as strong as a teacup of cereal to ten ounces of milk and water.

DR. CHARLES GILMORE KERLEY, of New York, stated that he had used thick cereal feeding in 14 cases of persistent neuro-pathic vomiting with very decided success. It had been a means of inestimable value in the type of children mentioned. He had used Dr. Harold R. Mixsell's mixture consisting of farina, cane sugar and dextri-maltose.

DR. LANGLEY PORTER, of San Francisco, said he had had a great deal of experience with thick cereal feeding. They had been using it for a number of years. He had been impressed with the fine condition of the children fed in this way; they were solid and hard, like well-fed breast babies. He supposed the good result was due to the fact that these flours were high in salts and the mineral balance was well maintained. Some babies on farina became constipated and a few got diarrhea. On some babies they had found that rice flour cooked in the same way would enable one to continue thick feeding and to overcome diarrhea. On the other hand, it had been brought out at St. Paul that rye flour was a laxative and by using it constipation might be overcome and the thick cereal feeding continued. They used a double boiler and cooked the cereal two hours.

They used 1 tablespoonful of farina to 5 of liquid, 1 to 7 of rice and 1 to 6 of rye flour to get good results. They had been much impressed with the value of thick cereal feeding in all cases in which high sacchyrolytic bacteria were found and where the stools were frothy and acid.

DR. ISAAC A. ABT, of Chicago, said he was not opposed to thick cereal feeding, but he wished to call attention to one danger, and that was that by feeding a high starch percentage one might produce indigestion. One should watch the percentage of starch and see that it was not too high. If one made the mixture with skimmed milk this danger might be produced easily. He thought it should be emphasized that the protein side must not be disregarded.

DR. KENNETH D. BLACKFAN, of Cincinnati, emphasized the desirability of giving water with thick cereals and starchy foods. He said they had used these starchy foods for a long time. Dr. McClure had used them in infants with pyloric stenosis and malnutrition who were not doing well on whole milk.

DR. CHAPIN, in closing the discussion, said that these feedings were only for temporary use. They were for those cases that had lost weight and in which the loss could not be stopped by ordinary means. All these babies were tried on normal formulas before thick cereal feeding was resorted to. He had found that the degree of thickness given by these formulas was better than that of the thicker mixtures. His nurse had improved upon the method adopted by Dr. Griffith's nurse. She pushed the cereal from the spoon into the baby's mouth with a tongue depressor. This was simply another method of feeding atrophic babies for a time until one could get them on a more rational formula.

#### A CRITICAL CONSIDERATION OF THE FOUR-HOUR NURSING AND FEEDING INTERVAL.

DR. THOMAS S. SOUTHWORTH, of New York, stated that the 4-hour nursing interval, advocated by Czerny, had been widely adopted in the expectation that it would clear away many of the difficulties of the nursery. Within limits, it had proved helpful, but like many other dicta from Mittel Europa it was too sweeping for universal application. The feeding of

infants was still but a poor thing, if only the needs of the majority were provided for. The supreme test would always lie in the skilful management of the individual. In a former paper attention was drawn to the longer or shorter period of adaptation which a very considerable number of new-born infants and their mothers had to go through before mutually satisfactory nursing, with attendant gain in weight, was established. The 4-hour interval appeared to be admirably adapted for the vigorous normal infant at full term, nursing a normal mother with an abundant supply of good breast milk. However, this group as a whole thrived in former days with regular 3-hour intervals or 2-hour intervals, or, indeed, in unregulated cases, where the infant asserted its own times and requirements. There have been certain types of more exceptional cases in which the longer interval proved distinctly superior. Two of these stood out in their appeal to the obstetrician. One was where tenderness of the mother's nipples with risk of infection and mammary abscess not only made shorter intervals more hazardous but painful nursing prevented the full maternal coöperation so necessary to the normal adjustment between mother and infant. The second was that not uncommon type, the over-rich, high-fat breast milk. Mothers also found the longer interval to their liking, as giving them more freedom and they very naturally favored it and advertised it. Many obstetricians were apparently the first to adopt it as a routine measure and when the case reached the general practitioner, he continued the custom. It seemed then that the longer interval was especially adaptable to cases that departed from the normal, in short, to cases of maladaptation.

Recognizing this fact, it was not only pertinent but vital to inquire whether the longer interval, found useful in meeting or avoiding certain conditions of maladaptation, might not, when adopted too enthusiastically as a routine, work injury to other important types of maladaptation. As a result of his experiences he had no hesitation in saying that it did. Premature infants required more frequent feeding than those born at term. He had seen dire results of applying to them an inflexible rule. Of full term infants there was the sluggish dormant infant with difficulty stimulated to take a sufficient quantity of breast milk in

5 nursings; there was the baby who was too weak or learned with difficulty to take the nipple especially from moderately malformed nipples and did not empty the breast; the nervous, inexperienced mother who did not know how to coöperate with the baby and defeated its efforts; there was finally the large and perhaps increasing number of mothers whose breast milk, while scanty and insufficient, was capable of being made abundant enough to establish maternal nursing wholly or in part if stimulation was maintained with adequate frequency. For the above cases the 4-hour interval was irrational and injurious. This was especially true of the last group. Such infants were further menaced when their failure to gain under a method not adapted to their needs led to the giving of substitute feedings. Complementary feedings given at the conclusion of a nursing, to make up deficiency in breast milk, were always justifiable when occasion demanded and should be employed more frequently but the substitution ignorantly made of one or more bottle feedings to take the place of already too infrequent breast nursings was the most scientific way of drying up breast milk and precipitating unnecessary weaning. In many instances complementary feeding, coupled with a return of shorter intervals, produced the best results. Because a 4-hour interval was applicable to breast feeding it did not necessarily follow that it was applicable to bottle feeding. It was a question in the writer's mind whether with young infants who must necessarily be brought up on the bottle, the total results were any better by adopting too rigidly the longer intervals. Certainly, very young infants were with difficulty given adequate amounts of diluted cows' milk and such infants ran the risk of being underfed. The acceptance of a hard and fast rule was a retrograde step at variance with our best traditions since the needs of the individual must be carefully weighed in reference to this factor of interval as well as to all other factors in infant feeding.

#### THE EFFECT OF COMPRESSED YEAST IN THE FOOD OF INFANTS.

DR. MAYNARD LADD, of Boston, said that it might be accepted as a general statement that the food for an infant must have the 3 known vitamins, fat soluble A, water soluble B,

and antiscorbutic C, vitamins and they must be present in sufficient amounts. There might be added as a corollary that it was no less important to have sufficient amounts of fats, carbohydrates and protein, mineral matter and water to meet the individual requirements of the child. Intelligent feeding presupposed that the physician had clearly in mind all these requirements when he undertook to prescribe a substitute for an infant. It might also be said that infant feeding had reached such a point that it was a rare exception when a normal baby could not be successfully reared on cows' milk properly adapted to its individual needs.

A large amount of experimental feeding had been carried out with lower animals to determine the part that was played by these 3 vitamins in the general problem of nutrition and this had contributed many practical suggestions to the principles of infant feeding. But in the writer's opinion there was a possibility that the conclusion reached in the feeding of rats, guinea pigs, fowls, dogs and pigs might be applied too directly to infants. Milk was not a natural food for these experimental animals except for a very limited period if at all. Obviously, experiments on the lower animals must be repeated and checked on human infants before their results could be accepted as practical for purposes of infant feeding. Osborne and Mendel of Yale, for example, had shown clearly that their experimental animals (rats) failed to show normal growth when milk was added to their diet, whereas with a small amount of yeast, normal growth followed. There was much evidence of a similar nature in the work of other men. The question the writer had in mind in the 10 cases herein reported was to determine whether the addition of such an accessory as yeast, which presumably was rich in water soluble B vitamins, would favorably influence the development of infants in the first year; the other factors being managed along lines of rational feeding.

It was obvious to anyone reading the advertising columns of some of our medical journals that certain commercial firms of a semi-medical nature were taking advantage of the present interest in vitamins to put into the hands of physicians, and of the public generally, products which, on the basis of animal experiments, were recommended as valuable growth promoters

for the human infant. The danger was that the general practitioner would be directed away from the principles of sound and scientific feeding in the hopes that a few pellets of metagen or the daily ingestion of a yeast cake would solve the problem of a deficient feeding case. An infinite amount of harm might result to the artificially fed infant if physicians attempted by such means to work out their feeding problems.

Dr. Ladd said he was not trying to undervalue the brilliant work done in the laboratory but he knew from personal contact with general practitioners that many physicians were likely to neglect the common sense of infant feeding in the faith that there was a "get-fat-quick" method embodied in the use of so-called vitaminized marketed under high sounding names. In the cases reported he had tried to determine only whether the compressed yeast added to the food which had been prepared and adapted as intelligently as he knew how had any special value as a weight producer. These babies were all cases of so-called difficult feeders and were carefully observed for varying periods. The weight charts which he showed all gave evidence of satisfactory development, but careful analysis of the rate of weight development during the periods with yeast and without yeast did not show, in his opinion, any benefit that could be attributed to the yeast itself separate from other factors entering into the feeding problem. As to the value of yeast in cases of acne and furunculosis, the series of cases gave no definite evidence. One case developed furunculosis while taking the yeast, obviously from contact with a baby similarly affected and in that case it had no prophylactic value. The only ill effects were in one baby that developed a severe fermentative diarrhea soon after the yeast was begun but later when this was corrected, it took another dose;  $\frac{1}{2}$  cake dissolved in boiling water with no bad effects, but still without benefit to its nutrition. In all cases but 2, a full yeast cake was given, being evenly divided in the day's feedings. In 2 very young babies  $\frac{1}{2}$  cakes were given.

#### THE PROTEIN REQUIREMENTS OF CHILDREN.

DR. L. EMMETT HOLT, of New York, stated that the total protein requirement was to a large extent dependent on the character of the protein given. Proteins differed greatly in

their amino-acid content. Vegetable proteins were lacking in amino-acids essential for growth, while animal proteins were much richer in these substances and corresponded more closely in composition to the proteins of the body. In adults, protein was required only for maintenance and repair; in children, in addition, protein must be supplied for growth. While vegetable proteins might be sufficient for maintenance, the animal proteins were needed for growth.

The protein furnished to the nursing infant was only from 8 to 12 grams daily up to 9 months of life; this was equivalent to only about  $1\frac{1}{2}$  grams per kilo. This small amount was sufficient for growth and maintenance during the most active period of growth. The reason for this was to be found in the very high per cent of the protein of woman's milk which was especially rich in amino-acids. When cows' milk was the food, a much larger amount of protein was required as the protein of cows' milk was deficient in some of the important amino-acids, especially cystin. It was therefore necessary to give 2 or 3 times as much protein as was contained in woman's milk.

Low protein or an insufficient amount of protein was one of the reasons for the failure of condensed milk as a food and also for the want of success which attended the use of such milk formulas as those which were based on the percentage composition of woman's milk.

No experimental work had been done, nor in fact was it possible to determine the exact protein requirement of growing children. It seemed wise, in view of the great need of protein for growth, to allow a liberal amount for growing children, especially since no harm had even been shown to result from protein given in these amounts.

Dr. Holt presented tables showing the amount of protein taken by 100 healthy children in their usual diets. These averaged 40 grams daily at 1 year; 60 grams at 6 years; 80 grams at 12 years; 115 grams at 16 years. About two-thirds of the protein taken was of animal origin and one-third was vegetable protein.



## THE ROLE OF THE FAT SOLUBLE VITAMINE IN RICKETS.

DR. ALFRED F. HESS, of New York, made this presentation which was illustrated by lantern slides. He said that, as was well known, there were 2 main theories of the etiology of rickets—the hygienic and the dietetic. So far as he knew, there had been no investigation of the hygienic theory. It had not been thought to be possible to investigate it. It had seemed to him that there was a way of approaching this so during the winter they had fed a number of infants on dried milk prepared in the summer, and instead of using the milk from the pastures in the summer they had used dried winter milk. It had been found that if the cow was on a ration that contained little grass the milk was almost vitamine free. Twelve children were fed on the summer milk in the winter and 8 children were fed on the winter milk in the summer. Peculiarly enough the same percentage of children developed rickets in both groups, so that apparently diet did not seem to make any difference. All those infants had excellent dietetic care and the external influences were the same for all. As was well known, rickets developed in any institution and in this institution there was a fair amount.

In order to continue the study, Dr. Hess stated that he made use of the ultra-violet ray and followed the course of the rickets with the x-ray. The cases treated with the ultra-violet light were very quickly cured as shown by the calcification of the epiphyses and this occurred in the winter time. In March and April, they tried sunlight, exposing the children gradually to the sunlight and in a few weeks calcification began. Some of these children were getting dried milk, some protein milk and some condensed milk and they had been on these diets at least 6 months.

Active rickets reached its highest incidence in January and its minimum in July. The healing of rickets was lowest in January and reached its height in August or September. Rickets was most marked in the winter or spring and least marked in the summer time. The ultra-violet light was given 3 times a week for 3 months, the time being gradually increased until the exposures were for 20 minutes at a distance of 125 centimeters.

The x-ray pictures showed the progress made in calcification of the epiphyses during this treatment.

These observations seemed to point to the fact that there was a hygienic factor in the etiology of rickets: It seemed that the question of sunlight was of dominant importance in the etiology of rickets. Someone might say that exercise as well as light, played a rôle but these children did not exercise more after they were subjected to the sunlight and ultra-violet light treatment than before. The moral was evident; it pointed to the value of sunlight in the prevention of rickets and furthermore, it showed the importance of sunlight in child-caring institutions and hospitals.

*Discussion.*—DR. ROWLAND G. FREEMAN, of New York, said it had always seemed to him that all we knew about rickets pointed to the fact that it was a disease caused by darkness. Children got rickets in the winter and not in the summer. About all the rickets we saw occurred in races used to a tropical climate. There were some very striking instances. In one Italian family coming under his observation, there were 6 children, 3 born in Italy and 3 in this country. Those born in Italy were apparently normal, while those born in this country had marked rickets. He did not believe it was going to be possible to say that rickets was a food disease when we saw such remarkable examples associated with bad hygiene and change in climate.

DR. E. C. FLEISCHNER, of San Francisco, said he had come to feel that the outside environment was a factor in the etiology of rickets and that the greater amount of sunlight and the outside environment explained, in part at least, why there was less rickets in California than in the East. Dr. Fleischner asked Dr. DeBuys with reference to the incidence of rickets among the colored children in the South.

DR. L. R. DEBUYS, of New Orleans, replied that rickets in New Orleans was very frequent among the colored children, more frequent than among the white. Speaking off-hand, he thought it was just as frequent in the rural districts as in the city. The negroes in the rural districts lived in about the same conditions as those in the city as regards overcrowding and diet.

DR. HENRY HEIMAN, of New York, called attention to the fact that in their investigations of rickets they had considered

only the osseous system, and no stress had been put on the other systems which were undoubtedly affected. He felt that there was an individual and a predisposing factor. He felt that rickets should be considered as involving the ligamentous, muscular and nervous systems, just as much as the osseous.

DR. ALFRED F. HESS, of New York, said that he did not mean to state that diet did not play a rôle in the etiology of rickets or that rickets was not a dietetic disease and could not be brought about by poor diet. When, on the same milk, 25 per cent. of the children would get rickets and the rest would not this showed that there was some individual idiosyncrasy. The point he wished to bring out was not so much the incidence as the cure of rickets by the ultra-violet light and sunlight.

#### A CLINICAL AND ROENTGENOLOGICAL STUDY OF ENLARGED THYMUS IN INFANTS.

DR. KENNETH D. BLACKFAN and DR. KARL F. LITTLE, of Cincinnati, presented this study which was illustrated with lantern slides. It consisted of a clinical and roentgenological examination of the thymus both in normal infants and in those who had presented symptoms referable to it. In a few instances, the findings were confirmed at autopsy. An extensive series of radiograms, taken before and after x-ray treatment, had been analyzed with reference to the diagnosis of enlarged thymus. The results indicated that an area of dullness in the region of the thymus, with a corresponding shadow in the roentgenogram, occurred in a relatively large number of normal infants. That this was due to the thymus was shown by the fact that the shadow became smaller after exposure to the x-rays. A thymus large enough to be demonstrated by percussion and to show on the plate did not necessarily cause symptoms. The observations of previous workers, that an enlargement of the thymus could be demonstrated by percussion and by roentgenograms, were confirmed.

*Discussion.*—DR. ALFRED FRIEDLANDER, of Cincinnati, called attention to the fact that the x-ray gave no idea of the antero-posterior dimensions of the thymus. One might have a large flat thymus that gave no symptoms though it gave a large shadow, whereas a thymus might be thick antero-posteriorly and

produce symptoms and yet give a small shadow. The mere fact of a large upper mediastinal shadow associated with enlargement of the thymus did not necessarily mean that symptoms were produced. It might be that as many as 46 per cent. of children would be found to show an enlargement of the thymus and a large percentage of these showed no symptoms. If symptoms of thymic asthma were present, even though the x-ray showed no shadow, radiation should still be given. In a study of 300 cases, they had found it worth while to employ radiation. Dr. Friedlander said he was in accord with the previous speakers that what an enlarged thymus meant was still to be determined.

DR. MAYNARD LADD, of Boston, cited the case of a child with a negative history who was seized with convulsions, high fever and cyanosis and who died suddenly. At postmortem the thymus was found to weigh 62 grams. It was difficult to understand how a gland of that size could exist without causing symptoms. It seemed that the symptoms might be due to an internal secretion rather than to pressure.

DR. CHARLES GILMORE KERLEY, of New York, cited a case in which there were typical classical asthmatic attacks which he diagnosed as being due to enlargement of the thymus. The x-ray showed no evidence of enlarged thymus. The child was given 4 x-ray treatments and had had no attacks since.

DR. JOSEPH BRENNEMANN, of Chicago, cited a case in which the x-ray showed a broad shadow, so broad that it approached the heart and yet there were no symptoms. If the child had had symptoms they would have been attributed to the thymus. It was important that more than one x-ray picture be taken. He had seen instances in which the thymus was apparently enlarged and when a second picture was taken it was not so apparent, due to the fact that one picture was taken at the end of inspiration and the other at the end of expiration. There was an idea that symptoms were aggravated for some hours after x-ray treatment. He would like to know whether others had found this to be true, and if it were whether it should lead one not to give the x-ray treatments at a time when there was more or less aggravation of symptoms.

DR. FRITZ B. TALBOT, of Boston, related that a short time ago his resident, Dr. Parsons, was making a study of rabbits. One

of the rabbits died suddenly, and the postmortem showed an enlargement of the thymus. This was the first time at the Massachusetts General Hospital that a rabbit was found with an enlarged thymus.

DR. LANGLEY PORTER, of San Francisco, said that in his experience he had noticed that a thymus might be enlarged and yet produce no symptoms. At the Stanford Hospital they had had a mongolian idiot who died at about 4 years of age of pneumonia. He had never shown symptoms of thymic asthma, but at autopsy a thymus was removed which weighed over 55 grams.

DR. HENRY HEIMAN, of New York, said that thymic asthma was a very rare disease. Cases of real thymic asthma were not hospital cases and the deaths occurred at home. Thymic asthma must not be confused with laryngismus stridulous, diphtheritic infection, and those cases that died suddenly in which one found a deformity of the glottis and epiglottis. Again, thymic asthma must not be confused with latent spasmophilia.

DR. ROWLAND G. FREEMAN, of New York, said he thought that thymic asthma was sometimes taken to be simply convulsions such as occurred with slight infections. In some of these cases the convulsions ceased after treatment with the x-ray. Dr. Freeman cited a case of thymic asthma in which the symptoms were relieved by x-ray treatment though the shadow on the x-ray plate was apparently larger than before the treatment. He had had 2 other cases treated without reduction in the size of the thymus. Dr. Gerstenberger's sign was very valuable. If one was dealing with a tumor in the upper mediastinum that got larger and smaller with inspiration and expiration, he might be pretty sure it was the thymus and nothing else.

#### ABDOMINAL PAIN AND THROAT INFECTION.

DR. JOSEPH BRENNEMANN, of Chicago, directed attention to a symptom that in his experience and that of his associates was of very frequent occurrence and, so far as he knew, had received little if any attention in the literature. This symptom was that of abdominal pain occurring often to the exclusion of all other subjective symptoms in the course of throat infections in children, including the whole series of upper respiratory

tract infections. The nature and location of this pain were fairly constant; the degree and time of occurrence varied much in different individuals. It might occur early or late and often persisted throughout the illness, sometimes lasting for weeks and even months after all other symptoms had disappeared. It might be more or less constant; more often it was distinctly intermittent. The child quite regularly indicated that the region of the umbilicus was the site of the pain. In this pain, nausea played no real part. The writer stated that he was convinced that in the causation of the abdominal pain of throat infections, indigestion, myalgia, gripping, aching neuritis of the head zone or a referred pain from the thorax or from the vertebral column, carried along the intercostal nerves played no part. In seeking the cause of this pain, one must direct his attention to the mesenteric and retroperitoneal glands. Several cases were cited in which operation was performed in the presence of severe pain of this kind and such enlarged mesenteric and retroperitoneal glands found. That inflamed and enlarged mesenteric and retroperitoneal glands, nontuberculous in origin, did occur was well known, and that they did occur in infections, having their primary seat in the throat, was evident in autopsies on cases dying from influenza during the recent epidemics. The pathogenesis of such enlarged glands was again a matter of speculation, as was also the question whether they themselves caused the abdominal pain, assuming that they were related to it, or whether some antecedent inflammation of the intestine, to which they were secondary, might cause it, or at least share in it. Two routes of infection were of course possible, by blood stream and by direct transmission. The former seemed improbable, for a marked general adenopathy was not especially characteristic of these infections. The true cause of the pain might be, at least in part, a localized enteritis or colitis, rather than lymphadenitis itself and possibly some specific or selective localization might account for the fairly constant pain in the umbilical region. This might better than anything else explain the varying nature of the pain, depending upon the site and degree of involvement and upon the amount of peristalsis that might be a factor in producing it. That the glands might, however, become involved secondarily, even to the point of abscess formation or

might continue to be enlarged for a time after the intestinal lesion was healed, was probable enough and exactly analogous to what happened in secondary adenitis of the cervical and retro-pharyngeal lymph glands following a throat or postnasal infection. Such glands could explain the recurrent pain in the abdomen. It was of practical value to know that there was such pain and to be familiar with its clinical setting. So long as the pain remained at the umbilicus or invaded the other 3 quadrants of the belly it left one uninterested and cool but when it occurred in the lower right quadrant, the abdominal spectre began to walk. It was then some comfort to know that in children this pain was much more severe and frequent in this region than was that of appendicitis. It was a still greater comfort to be able to connect the pain with a well marked throat infection or an otitis media or cervical adenitis or a cough. One must not, however, allow this type of abdominal pain to cause him to overlook appendicitis.

#### OBSERVATIONS MADE IN A SERIES OF CASES OPERATED UPON FOR TONSILS AND ADENOIDS.

DR. L. R. DEBUYS, of New Orleans, presented this paper which was based on a series of 346 cases operated upon for the removal of tonsils and adenoids. They were admitted to the Touro Infirmary through the nose and throat division of the out-patient department since January, 1920. At the suggestion of the writer, the routine of referring all tonsil and adenoid cases to the pediatric department, before being admitted for operation, was adopted. The examination consisted in the usual physical examination with special reference to the heart and lungs. Examination was also made of the urine of each patient, and the coagulation time of the blood was determined. Upon the o. k. of the pediatric department, patients were admitted for operation. By this routine, the writer was informed, the operators had a sense of greater security.

Of the 346 cases operated upon, 195 were males and 151 females. In 46.8 per cent. of the cases, there was history of sore throat; in 21.6 per cent., the patients were subject to "colds"; in 19.2 per cent., the complaint was mouth breathing; in 7.6 per cent., there was difficulty in swallowing. Others gave a history

of snoring, of enlarged glands, of deafness or of previous abscess. There were systolic murmurs at the apex with perfect compensation in 2.7 per cent. of the cases. These patients withstood the operation uneventfully. No cases were operated upon in which any pathology of the kidney existed.

The blood coagulations varied from 30 seconds in one case to 7 minutes and 50 seconds. All cases, with a coagulation time of 6 minutes and over, were deferred for operation until the time was brought down to less than 6 minutes. Calcium was employed for this purpose. In one instance, the coagulation time of the blood was brought down from 7 minutes to 3 minutes and 40 seconds in 23 days; and in another, from 7 minutes and 15 seconds to 3 minutes in 14 days. The diagnosis in 95 per cent. of the cases was chronic tonsillitis and hypertrophied adenoids and in the remaining 5 per cent. the tonsils were principally involved, and the adenoids were also removed.

Four types of anesthesia were used, namely, ether, ether-gas sequence, ethylchloride-ether sequence, and nitrous-oxide-anesthol-ether sequence. Ether was administered in 90.2 per cent. of the operations. The periods over which it was given varied from 12 to 53 minutes. There were no accidents and in only 4 instances was there anything unusual during the anesthesia. In 2 instances, there was recorded cyanosis during anesthesia, not sufficient to interfere with the operation; in one instance, the condition of the patient was reported as poor during the operation, and in one instance, as bad. None of these occurrences were in cases in which there were heart murmurs.

The duration of the operation varied from 5 to 42 minutes. It was of interest to note that during the period of these observations there were hemorrhages in 4 patients not included in this series and not examined according to this routine.

There were no complications following the operations. In all the cases, already referred to, the condition was recorded as good or very good during the operation and remained so after it. The reactionary temperature ranged from normal to  $101.8^{\circ}$ , and lasted only a few hours, the patients having a normal temperature when leaving at the end of 24 hours. Vomiting was recorded in 70 per cent. of the cases following operation. In 30 per cent. of the cases, this symptom was not recorded. The



duration of the stay in the hospital was 24 hours with 5 exceptions; the delay in these cases was due to inconvenience rather than discomfort.

An attempt was made to follow these cases and to get into touch with the parents. While reports had not come from all the cases, about 200 have been received, in all but 4 of which the comments were most glowing. Three of these were much below par at the time of the operation, having had most of the infectious diseases. In the fourth, whose complaint was headaches, this symptom had continued. The writer expressed the belief that the pediatricist should pass upon all children to be operated upon for the removal of their tonsils and adenoids so as to reduce to a minimum the possibility of accidents.

#### SEVERE INFANTILE MALNUTRITION, THE ENERGY METABOLISM, WITH REPORT OF A NEW SERIES OF CASES.

DR. FRITZ B. TALBOT, of Boston, stated that most methods of study of this condition did not give results which explained what was going on in the body. This could best be shown by the energy metabolism and that it was the purpose of this investigation to show the similarity between the metabolism of infants, with slight loss of weight, and those with severe malnutrition or so-called atrophy. A new series of cases was studied by the writer during the past 2 years at the Massachusetts General Hospital. This series was comparable with the investigations of Benedict and Talbot, Murlin and Hoobler, and Flemming, because the metabolism in all these studies was obtained under basal conditions. In this new series, the cases were all underweight to a greater or less degree and represented malnutrition due to a variety of causes. A table showed a comparison of the heat production of infants of like body weight and height but of different ages. It showed a higher metabolism for older infants than for younger infants of the same size. This was of significance because the older infants had a greater degree of malnutrition than the younger infants with which they were compared. A chart also showed what had been recognized for some time, namely, that the heat production per kilogram of body

weight was higher in the malnourished or marasmic infant than in the normal infant.

It was shown that there was a group of cases that had a low metabolism per expected weight; the cases with the greatest degree of malnutrition had apparently the most abnormal metabolism. This finding was rather difficult to explain, but allowed of 2 explanations: (1) Because of the malnutrition there was a diminished amount of active protoplasmic tissue to make heat, or (2) there was a normal amount of protoplasmic tissue but because of the malnutrition or some concomitant factor the heat forming tissues were incapable of making the same amount of heat as during health. The composition of the body showed little or no difference between the percentage of nitrogen in well-nourished, fat infants, thin infants, or markedly malnourished infants, and it might be assumed that the proportion of protein tissue in malnutrition was not abnormal. Before this could be accepted however, further investigation was necessary. If the protein tissue was the only active tissue involved it would then seem that it was not functioning to the same degree in making heat in severe malnutrition as in health. The evidence produced was against there being a quantitative diminution of the active protoplasmic mass and it might be assumed that the first possibility was ruled out. The second possibility conformed with clinical experience and might be taken as the more plausible explanation.

It was conceivable that when the metabolism became so depressed that the normal temperature could not be maintained except by the external application of heat, these infants had entered into the same category as the cold blooded animals, the level of whose metabolism was determined in general by the surrounding temperature. It was shown that cases of malnutrition produced fewer calories than did normal infants of the same age. A reasonable explanation of this was found in a table which showed that the total amount of nitrogenous tissue was in general dependent upon body weight. The study also seemed to show that heat production, greater than normal, was necessary to maintain the body temperature of these infants with malnutrition because of the relatively increased body surface and

absence of "protective" or "insulating" covering of subcutaneous fat.

There was no appreciable change in the metabolism of cases with severe malnutrition until there was a loss of 20 per cent. in the body weight. Beyond this point there was presumably a loss of subcutaneous fat and a relative increase of body surface. With the increasing malnutrition the divergence from the normal became greater and body heat was lost more easily because of the lack of the insulating layer of subcutaneous fat and of the greater radiation of heat due to the relative increase in body surface as compared to the weight. When the heat loss became greater than the heat production, the temperature became subnormal. This condition could only be remedied by the application of enough external heat to make up for the loss. The basal metabolism per kilo body weight was higher in infants with severe malnutrition than in normal average infants, being higher the greater the degree of malnutrition.

*Discussion.*—DR. THOMAS S. SOUTHWORTH, of New York, said he thought Dr. Talbot had given a very valuable demonstration. In looking over some old reports, he came across the work of an investigator which showed that an atrophic infant used up 2 ounces more of milk if its head was exposed. From this it was deduced that in smaller children wearing a cap in the cooler weather conserved the body heat. The same thing was applicable to older children. In thin and anemic children the nutrition could be helped markedly by using flannels as the extra protection favored the nutritional and metabolic processes. Fashion was very irrational when it decreed that children should go with their legs exposed in cool weather.

#### A FEBRILE EXANTHEM OCCURRING IN CHILDHOOD.

DR. BORDEN S. VEEDER and DR. T. C. HEMPELMANN, of St. Louis, presented this contribution in which they described conditions met within a group of cases characterized by high fever, lasting 3 or 4 days, followed by the development of an eruption coincident with the fall of fever; the eruption faded within 24 to 48 hours. During the febrile period, there was an entire absence of all physical signs or symptoms. There was no coryza, tonsillitis, cough, bronchitis, lymphatic enlargement, splenic en-

largement, diarrhea, constipation, etc., present. The most striking thing was the complete absence of symptoms accompanying the high fever. One patient waited for the development of a concealed pneumonia or some such cause of obscure fever when suddenly the rash appeared and the temperature dropped. They had seen in all 20 of these cases during the past winter, in 8 of which a blood count had been made, and the only striking sign they had noted was a distinct leucopenia with relative lymphocytosis; the blood count was the only diagnostic clue. The leucopenia dropped as low as 3200 cells in 2 cases. In all but one of the 8 cases there was a relative lymphocytosis present, amounting to from 80 to 90 per cent. With the exception of a relative increase in lymphocytes and a relative decrease in the polymorphonuclears, the other cells stood in normal relation to each other. Most of the cases occurred in the second year.

In none of the reported cases, nor in any of the other cases observed, had a second case been seen in the same family. The disease, therefore, seemingly did not belong to the ordinary group of exanthemata in childhood, transmitted by direct contact. The eruption was morbiliform and consisted of small red macules or maculo-papules from 1/16 to 3/16 of an inch in diameter. They pressed out easily, similar to a rose spot. The lesions were usually profuse and fairly well distributed over the body, lower part of the face, neck, and extremities. It was their belief that the symptom-complex was a specific entity which was not described in the text books. Dr. Zahorsky had described this symptom-complex in 1910 as "roseola infantilis" and again in 1913 as "roseola infantum." His description agreed with the picture they had been observing. They did not consider that roseola infantum was the proper name to apply to this symptom-complex as it formerly pertained to a large indefinite group.

*Discussion.*—DR. ROWLAND B. FREEMAN, of New York, said he thought they all saw these cases. They were very common. The children ran a temperature for 3 or 4 days and after the fall in temperature they developed a rash. He would not be sure they did not have catarrhal symptoms.

DR. THOMAS B. COOLEY, of Detroit, stated that they had had the identical thing in Detroit. The blood picture was the same and the exanthem the same. It had been occurring where there

was an outbreak of paratyphoid B fever and it was extremely difficult to differentiate it from paratyphoid B fever. The only way it could be differentiated was by blood culture.

DR. JOHN RUHRÄH, of Baltimore, stated that he had seen 16 cases of this entity, but would reserve his description for some other time.

DR. HENRY F. HELMHOLZ, of Rochester, Minn., said they had had a small epidemic of this entity. The cases he had seen corresponded with Dr. Veeder's description. In a group of 3 cases in one family, the eruption was of the urticarial type and the symptoms more severe.

DR. HENRY HEIMAN, of New York, said he supposed they all saw these cases and the clinical diagnosis was usually intestinal toxemia accompanied by urticaria or erythema. It would be interesting to study the milk supply.

DR. JOSEPH BRENNEMANN, of Chicago, asked whether Dr. Veeder had any drug which he used as a routine, such as aspirin.

DR. BORDEN S. VEEDER said that none of these children were receiving any drugs. He had eliminated the possibility of a drug rash. There were no toxic symptoms. These children came from all sections of the city and mostly from the better classes. They were not getting milk from the same dairy.

#### INDICATIONS FOR REMOVAL OF THE SPLEEN IN INFANTS AND CHILDREN.

DR. FREDERIC H. BARTLETT, of New York, reviewed the most recent studies of the function of the spleen and cited reported splenectomies in children under 12 years of age and their subsequent histories. He said that hemolytic jaundice, Gaucher's disease, Banti's disease, and von Jaksch's anemia were 4 names given to pathological processes for the relief and cure of which removal of the spleen might be the only treatment. Banti's disease and Gaucher's disease had no distinguishing symptoms and physical signs by which they could be clearly differentiated. It was impossible to establish the identity of either of these conditions in their early stages, and it was just in the early stages that splenectomy was of the greatest value. von Jaksch's disease was still *sub judice*, being regarded by some as not a distinct entity. In view of the difficulty of giving a name to

certain symptom complexes in which anemia and a large spleen were the prominent manifestations, and for which splenectomy might be the only proper treatment, it was necessary to have certain criteria for the removal of the spleen. These criteria were brought out in the analysis of 3 cases reported in the paper, two cases of Banti's disease and one of Gaucher's disease, all treated by splenectomy. In the 41 cases collected from the literature, no instance of leucemia appeared. This disease, above all others, must be excluded in a decision to remove the spleen. Removal of the spleen in leucemia was contra-indicated. The first case presented the anomalous situation of a spleen which recorded the changes belonging to Banti's disease and the blood picture belonging to von Jaksch's disease. If the 2 diseases were a distinct entity, the logic of the situation forced one to accept the proposition that the causative agent of von Jaksch's disease had elaborated its effect on the hemopoietic system; the causative effect of Banti's disease had elaborated its effect in the spleen.

Emphasis was laid on the statement that a distinctly enlarged spleen might be a part of a pathological condition, the relief or cure of which depended upon the removal of the spleen; and second, that such an enlargement might be present in the first year of life. A study of the charts of repeated blood examinations in the 2 cases of Banti's disease showed in each instance a diminution in the number of erythrocytes, a hemoglobin percentage below normal, and leucopenia. The erythrocytes showed poikilocytosis, polychromatophilia, and marked pallor. These blood findings defined secondary anemia, which was characteristic of Banti's disease. The combination of a persistent blood destruction and of an enlarged spleen in spite of repeated transfusions and failure of radium to reduce the size of the spleen furnished a good starting point for serious consideration of splenectomy. It was desirable, however, that a thorough search for evidence of blood regeneration, as well as of blood destruction, be made when one was confronted with the problem of splenectomy. Studies of the blood after splenectomy furnished a good index of the degree of improvement in the condition for the relief or cure of which the spleen was removed.

A study of the case of Gaucher's disease described furnished additional criteria to assist one in a decision to do a splenectomy.

#### THE DIAGNOSIS OF TUBERCULOSIS IN CHILDHOOD.

DR. CHARLES HENDEE SMITH, of New York, made this presentation. He stated that there was a widespread misconception in the minds of the medical profession concerning the prevalence of tuberculosis in childhood, the methods by which the diagnosis must be made, and the significance of the skin reaction. Tuberculosis was not a universal disease in childhood in this country, at least. The universal findings in Europe did not hold in America. The diagnosis of the presence of tuberculous infection rested largely upon the skin reaction which was of value at any age. The reaction did not determine whether any given lesion was tuberculous, but did tell whether a child had been infected or not. The technique of the various skin tests was important. The value of the reaction was commonly lost by careless methods. The activity of tuberculosis must be judged by the temperature curve and by the other signs of toxemia (malnutrition, anemia, etc.). The site of the lesion was often difficult to find. The bronchial nodes were most commonly involved, yet gave but few signs. D'Espine's sign was the best of these; its value was not widely appreciated. The manner in which it was elicited and recorded had not been standardized. The present report was concerned with an analysis of 550 cases with reference to this sign. The x-ray should show tracheo-bronchial enlargement but was often disappointing. D'Espine's sign, below the third and especially below the fourth dorsal vertebra, was very suggestive of tuberculosis.

*Discussion.*—DR. FRITZ B. TALBOT, of Boston, asked Dr. Smith whether he had any records in this group as to whether any of the children had had whooping cough. He had made a series of observations during and after whooping cough which showed marked enlargement of the bronchial lymph nodes by the x-ray.

DR. JOSEPH BRENNEMANN, of Chicago, called attention to one precaution that should be taken when one got a series of negative von Pirquet reactions, where before he had been getting

positive reactions. When that happened one should make control tests with a different tuberculin.

DR. W. PALMER LUCAS, of San Francisco, mentioned that another condition might also give the D'Espine sign, namely a low grade influenzal infection. In quite a series of cases of that kind they had found the same picture Dr. Smith had described, namely, the D'Espine sign positive below the fourth and extending down to the seventh or eighth dorsal vertebra; in these cases the von Pirquet was negative, yet there was a positive clinical picture.

DR. LANGLEY PORTER, of San Francisco, said that he believed D'Espine's sign was a very valuable and much neglected addition to our clinical methods. He had never found D'Espine's sign below the fifth and rarely below the fourth dorsal vertebra where there was not some definite change. The position of the patient was important in determining the point at which the sign was heard. Dr. Smith said he made the examination with the patient in the erect position. They seated their patients with the back flexed and the head bent forward; then they usually heard the sign at about the fifth dorsal vertebra. It would be an advantage to have a standard position.

DR. J. CLAXTON GIDDINGS, of Philadelphia, said the number of positive von Pirquet reactions was high. He felt that the von Pirquet reaction represented the number of infections, but he felt strongly that the clinical fact that we saw so little tuberculosis between the ages of 4 and 14 probably depended upon the dose of infection and the resistance of the subject. He believed that many cases of malnutrition and undernutrition were dependent upon neoplasms in the glands that could not be definitely proven.

DR. SAMUEL MCC. HAMILL, of Philadelphia, referred to a series of cases in which he had applied the Calmette, the Moro and the von Pirquet tests, which indicated that the von Pirquet test had the same measure of accuracy as the Calmette, and also that the Calmette test was a failure as an indication of the incidence of tuberculosis. Dr. Hamill emphasized the importance of careful technique in the application of the von Pirquet test.

DR. CHARLES HENDEE SMITH, of New York, stated that



whooping cough, influenza or any affection that gave an inflammatory reaction in the lung might give D'Espine's sign. One must rule out other lung conditions before making a diagnosis on the D'Espine's sign. The tuberculin used in making the tests should be tested out frequently on known cases. A great deal of value attaches to percussion and it often gave positive findings, but it was not easy to teach a young man to percuss lightly and to elicit the more delicate signs, while it was comparatively easy to learn to elicit D'Espine's sign.

#### CERTAIN ASPECTS OF SCHOOL MEDICAL INSPECTION.

DR. FRANK SPOONER CHURCHILL, of Milton, Mass., asserted that the assistance of extra school agencies appeared to be indispensable at present in the medical inspection of schools if the work was to be carried out in its entirety. He said he had just completed 2 years of work as medical director of the public schools in a suburban town in Massachusetts with a total population of approximately 9,000 and a school population of approximately 1,600. There had been available for it at first only 2 physicians, 1 school nurse, the grade teachers, 2 teachers of physical training and certain community organizations. There were 7 grade schools; 5 located in the more thickly settled districts had been visited on the first 4 mornings of the week by either the school nurse or Dr. Churchill. The local board of health at their suggestion had just adopted regulations allowing exposures to varicella, measles and mumps to attend school for a certain length of time after exposure, consequently no report could be made on the effect of this policy. The developmental side of this work had received special attention; general examinations had been made annually of all pupils in the school system; special examinations had been made of participants in foot ball, basket ball and of backward and mentally deficient children, the pupils of the latter group being sent to the Boston Psychopathic Institution for expert opinion. The work of general examination had been subdivided between teachers, school nurses and school physicians. Weighing, measuring and, recently, the testing of sight and hearing had been done by grade teachers; in the examination of the head and scalp, teeth, spine,

posture and feet, by the school nurse. After that the school physicians, Dr. Augusta Williams for the girls and himself for the boys, had examined nose, throat, teeth, glands, heart, lungs, spine and feet. All data of each pupil was recorded on a tabular card of such size and arrangement that one card would suffice for the examinations made year by year. In addition to the complete examinations made once a year, all pupils in the grade schools had been weighed once a month, the records being kept for inspection by the children themselves. Provision was made for the correction of defects.

The results of this work carried on in the public schools of an average American suburban town were instructive and suggestive. The chief interest centered in the general nutrition of the pupils and in certain local anatomical defects. In the study of the nutrition, the figures for weight, height and age published by the Child Health Organization of New York were taken as a standard as a basis for comparison. The total number of children examined was 1,552 in 1919, of which 39 per cent. were under weight and 16 per cent. were 10 per cent. or more under weight; in 1920, 1,569 were examined and 56 per cent. found under weight, 23 per cent. were 10 per cent. or more under weight. The explanation offered for this increase in under weight was that about 1/5 of the children of this community entered school handicapped by a severe state of malnutrition. The effect of school life upon the malnutrition appears to be nil, but in the school course there was an increase in numbers showing malnutrition and this takes place in the storm and stress period of early puberty, subsiding with the complete establishment of puberty. The report on anatomical defects confirmed well known figures. There was a satisfactory absence of tuberculosis.

These studies suggested definite lines of procedure; prevention of malnutrition as early in life as possible; checking its progress in school life, correction of physical defects. In order to attack the malnutrition as early as possible, an infant welfare clinic had been established which received pregnant women, infants and children of pre-school age up to 5 years. To check the condition among older children, various steps had been taken to improve the hygienic conditions under which the child lived

at home and corrective work as to teeth, tonsils, and adenoids was proceeding in the usual way.

## RESPIRATORY INFECTIONS IN SCHOOL CHILDREN.

DR. RICHARD M. SMITH, of Boston, stated that the present study was undertaken in the hope that some suggestions might result as to a more definite means of combating respiratory infections. No definite line of attack could be suggested from the evidence at hand. It had demonstrated clearly several things, the most striking of which was our lack of real knowledge with reference to these infections and the necessity of further study. The figures in this connection were taken from Mr. Rivers' Open Air School for Boys in Brookline. During the years 1917 to 1921, out of a possible 100 per cent. attendance, illness caused absence of 11.62 per cent. in 1917-1918; 9.76 per cent. in 1918-1919; and 12.77 per cent. in 1919-1920. This was 2 or 3 times the per cent. of absences not connected with illness. Of the absences, due to illness, respiratory infections caused about 54 per cent.; contagious diseases and quarantine, 24 per cent. Respiratory infections were twice as great as those from contagious diseases except in one instance when a mumps epidemic made a large number of absences from contagious disease. These figures were compared with another school for boys in the same community. The same general proportions were present there also. Lee reported in Harvard College 14 times as many absences from upper respiratory infections as those on account of the so-called contagious or quarantine diseases.

Particular care was necessary during the winter months of January, February and March. Repeaters should be given careful individual study for their own sakes and because they might be the means of spreading infection to others. Many of these could be made normally resistant by the removal of diseased tonsils or the improvement of their general condition. Progress in the reduction of these infections could be made only if we appreciated their importance sufficiently to study the problem. More knowledge was needed from the physician and greater co-operation between the school authorities and parents to apply the knowledge which we already possessed.

A detailed study was made of the respiratory infections

during the period of greatest prevalence to determine, so far as possible, the facts with reference to the distribution of the infections. From these facts an attempt was made to detect any possible channels of infection in the school. Respiratory infections were most numerous during the months of January, February and March. In general they were a little more prevalent and of longer duration in the lower grades. Other schools also showed greater prevalence of illness in these grades. A study was made of all pupils absent from respiratory infections during the month of January to determine, if possible, any connection between their proximity in the school room, during rest periods, at meals, during classes, or during transportation. Definite contact infection could not be proved. It was striking, however, that the distribution of respiratory infections at any one time was in general among boys who were near together, particularly those who were near together at rest periods or in music. This would seem to indicate the desirability or particular precaution during times of close contact or when using the voice.

The results of this study indicated clearly that we needed to have more exact scientific knowledge with regard to respiratory infections, especially in the detection of individuals spreading infection. By paying greater attention to possible contacts, particularly in the exclusion from school of every suspicious boy and in being as sure as possible that no boys returned to school too soon after infections, we might materially reduce them. Attention must also be given to week end exposures.

#### A STUDY OF BREAST FEEDING POSSIBILITIES IN A SMALL INDUSTRIAL COMMUNITY.

DR. THOMAS B. COOLEY and DR. WYMAN C. COLE, of Detroit, presented this paper which embodied the results so far obtained in a trial made under the auspices of the Babies' Milk Fund of Detroit of systematic propaganda for breast feeding conducted along lines almost identical with those described last year by Dr. Sedgwick to whom they acknowledged their indebtedness.

Their design in making this trial on a small scale had been to form some judgment as to how far and in what form it might be desirable to apply this particular method of infant welfare

work to larger communities; and at the same time to develop their method and to have a training ground for nurses.

The locality selected was a small suburb of Detroit, comparatively isolated and peopled mostly by the laboring class. The birth rate in 1920 was 37.1 and the infant death rate for the same year was 8.

An analysis of the statistics presented permitted of the following conclusions: (1) It was possible by propaganda of this type considerably to increase the number of breast fed babies, even in a community where the tradition of nursing the baby was evidently as strong as in River Rouge where this experiment was carried out. (2) The more brilliant results were obtained with women nursing their first babies, and special attention to this class would probably best repay one's efforts. Mothers of more experience were, however, often susceptible to instruction which enabled them to succeed after previous failure. (3) The work had extended over too short a time to show any effect on infant mortality. They believed from their brief experience that this special propaganda was a valuable adjunct to more common types of infant welfare work. It would, however, be of little use without the service of the special nurse, really well trained in breast feeding methods, and especially in ways of stimulating breasts whose production was inadequate. The statistics showed a remarkably high percentage of successful breast feeding from 96 plus per cent. at the end of one month to 83 plus per cent. at the end of 6 months. Their efforts had enabled some mothers to successfully nurse their babies after previous failures.

#### MANAGEMENT OF A DIPHTHERIA OUTBREAK IN A PRIVATE SCHOOL.

DR. E. C. FLEISCHNER, of San Francisco, stated that Schick had placed diphtheria from the hygienic standpoint upon an entirely new basis. Formerly, in some places, an outbreak of diphtheria was handled by sending the students home and leaving them to the very uncertain management of the family doctor. In others, more properly supervised cultures were taken in the school, carriers sent home with instructions as to isolation, and prophylactic doses of antitoxin given either in school or by a medical adviser at home. The school was invariably closed for

a considerable period of time and often numerous fantastic procedures employed to disinfect rooms or correct errors in plumbing, hoping thereby to prevent a recurrence of the disease by methods absolutely futile. Briefly summarized, this method of handling a diphtheria outbreak could be harshly criticized for the following reasons: (1) It placed the responsibility for the control of the situation upon too many, often incapable, heads. (2) It was conducive to a spread of the disease by the formation of new and distinct foci. (3) It entailed the administration of a foreign serum to all the children, whether it was necessary or not. (4) It disorganized the school. (5) In view of our present conception of immunity and prophylaxis of diphtheria, it could not possibly be either efficient or successful.

An outbreak of 3 cases of diphtheria in a boarding school having 150 students was successfully controlled without disorganization of the school, though there was a certain human element bound up in a problem of this kind that taxed the ingenuity and patience of those who had it in charge. An interesting fact learned from a careful study of the records of this outbreak was that the percentage of positive Schick tests was 65. It suggested the possibility, considering that these boys came from a stratum of society where diphtheria was not prevalent, that repeated exposures to the disease played a role in the development of a natural active immunity.

In summarizing Dr. Fleischner emphasized the following facts as a means of controlling a diphtheria outbreak in a boarding school: (1) Immediate isolation and treatment of the sick children. (2) Immediate carefully supervised nose and throat cultures on all members of the school. In the taking of cultures the swabs should be introduced far back into the posterior portion of the nares, and from the crypts of the tonsils, if the tonsils were present, and when removed the cultures should be taken from the tonsillar fossae and as high up on the posterior pharyngeal wall as possible. (3) Schick tests with proper controls on all members of the school within 24 hours. (4) Administration of 1,000 units of antitoxin subcutaneously to all children having positive Schick reaction at the end of 48 hours. (5) Reculture of noses and throats and all contacts two days after the primary culture. (6) Any ill child should be isolated from

the healthy children and from true diphtheritics until a positive diagnosis was established. (7) All of the carriers should be immediately isolated and where it was possible, toxicity tests should be employed to avoid the exposure of those children having diphtheroid to those with true virulent organisms. (8) When the outbreak was controlled, active immunity should be conferred upon all children with positive Schick reactions by the proper injection of toxin antitoxin mixtures.

#### LEFT HANDEDNESS AS AN EDUCATIONAL PROBLEM

DR. AUGUSTUS CAILLÉ, of New York, stated that left-handedness could be traced back to antiquity and cited biblical evidence of the efficiency of the left-handed. The study of the problem of sinistrality naturally led up to the question—What can be done to bring about a more adequate adjustment of a left-handed child to a right-handed environment or as Beeley expressed it, "If left-handedness is hereditary, to what extent is it expedient to force a sinistral to become right-handed?" In view of the probability that left-handedness had a structural atavistic basis and was not merely an acquired faulty habit, the disciplinary attitude of parent and teacher toward left-handedness should be adjusted to the degree and character of its manifestations. Mild types, in which the stimulus for preferential action was weak, were readily overcome by educational efforts. *Vice versa*, it was not difficult to train the left hand when the use of the right hand was lost through injury or disease.

Mirror writing with sinistrality could be overcome in some instances by giving simple exercises which would make the child appreciate the discrepancy between his reproduction and the copy. Results would depend upon the degree of anatomical disturbance. In persistent sinistrality, particularly if combined with speech defects, right-handedness should be encouraged but never forced. Unreasonable discipline created an unbalanced condition akin to mental chaos. One might with more confidence rely more upon an internal or self-imposed discipline which inevitably came sooner or later, even though the preferential instinct might remain to a certain extent throughout life.

According to G. D. Robbins, Director of the Boston Stammerers Institute, sinistrals with speech defects might overcome

cerebral congestion and encourage normal speech, by slow and moderately deep breathing exercises. The correction of eye strain and of nasopharyngeal obstruction must not be overlooked and hygienic living in its broadest sense was of importance. Finally, we must avoid forming an exaggerated estimate of the difficulties experienced by left-handed persons in the ordinary actions of life. Such individuals became ambidextrous, which in many ways was an advantage. The condition of brain and cord would improve if all their motor and sensitive elements were fully exercised, therefore parents and teachers should encourage and train the free use of the right hand without suppressing the innate dexterity of the left.

#### MYOCARDIAL DEGENERATION IN CONGENITAL SYPHILIS.

DR. ALFRED FRIEDLANDER, of Cincinnati, stated that myocardial degeneration in infancy and in early childhood, in very many instances, rested upon a basis of congenital lues. The fact that myocarditis in early life was not infrequently due to congenital lues had not had the clinical recognition that it deserved. We were accustomed to attribute myocardial degeneration in early life to certain of the acute specific diseases, notably diphtheria, typhoid, pneumonia and influenza. We knew that acute rheumatic fever produced not only valvular lesions, but in many cases very definite degeneration of the heart wall. But we had not paid sufficient attention to the role of congenital lues in the production of myocardial degeneration. There was no typical form of myocarditis which might be recognized as luetic. The signs and symptoms varied in intensity in individual cases, and were the ordinary ones,—enlargement of the heart, feebleness of the first sound and, at times, a systolic murmur at the apex. Arrhythmia was common. Typical auricular fibrillation was almost never seen in childhood. Wassermann's test was not always positive evidence even in well marked cases. It was interesting to note the rapid improvement of the cardiac condition in these cases on simple, intensive antiluetic treatment alone. In many cases, syphilitic myocardial degeneration might be the only manifestation of congenital lues. Warthin considered syphilitic myocarditis an important cause of death in early life



recurring often in apparently healthy children in whom syphilis may never have been suspected clinically. Antiluetic treatment was suggested in myocarditis in young children irrespective of a positive Wassermann test, and regardless of the fact that other definite signs of congenital lues are lacking.

*Discussion*—DR. BORDEN S. VEEDER, of St. Louis, said he was interested in this paper because of his experience in seeing several hundred syphilitic children within a few years and among them myocardial and other cardiac children were rather uncommon. He was also interested because one frequently found in adults a condition that he could not diagnose as syphilitic in origin. In about 500 cases, he had seen only one aneurysm and he felt very doubtful about the syphilitic heart. He felt that simply finding the spirocheta in heart disease did not necessarily mean that the pathology was due to syphilis.

#### THE HEALTH CENTER—WHAT IT MAY MEAN TO A COMMUNITY.

DR. J. H. MASON KNOX, JR., of Baltimore, presented this contribution, in which he said that Americans were a life-wasting people. The unnecessary high death rate was not appreciated by the average citizen largely because he had not had the effect of living under good sanitary conditions concretely proved. This was the idea of the health center. It was the application of approved methods of public and personal hygiene to all the people of a given community. It was the establishment on a small scale of an ideal health department for the purpose of demonstrating results. Such a center secured community service in health. Few of the many health centers already established were complete. The immediate problems must vary in different places. Where there were no public health activities these were started *de novo*. In older communities the health center sought to coordinate and strengthen existing organizations and clinics, public and private. It was believed that when the results in improved health and happiness in a given area had been actually demonstrated the cause of public health in America would be furthered as was possible in no other way.

## THE CLINICAL VALUE OF INTRAPERITONEAL INJECTIONS OF SALT SOLUTION.

DR. J. CLAXTON GITTINGS and DR. JOHN D. DONNELLY, of Philadelphia, stated that in the treatment of dehydration seen so frequently in children suffering from gastrointestinal disorders with diarrhea during the summer months they had found that the most efficacious means of introducing fluid was by the use of the nasal tube, or by intraperitoneal injections. The other methods were either too painful or allowed the introduction of insufficient amounts of water. The intravenous route possesses certain dangers and might well be reserved for the introduction of solutions of glucose or glucose acacia. The nasal tube was preferable to the stomach tube, as being less likely to cause vomiting. It should only be introduced well beyond the epiglottis and not through the cardia. This also seemed to be less apt to cause regurgitation. From 150 to 250 c.c. of water could be introduced 2 or 3 times in 24 hours, from 3 to 3½ hours after the last feeding. Intraperitoneal injections seemed to be safe provided the bladder was empty, the abdomen was not distended and the fluid was introduced slowly. The amounts to be used vary usually from 150 to 300 c.c., the optimum to be judged by the subjective and objective symptoms. Disturbance of respiration and pulse and increasing distention indicate withdrawal of the needle. One hundred and sixteen patients received 352 intraperitoneal injections of normal saline. Comparison with the mortality showed the oldest cases and those having the highest weight on admission showed the greatest proportion of recoveries. The mortality increased *pari passu* with the number of injections, being the highest in those receiving 10 or more. Dehydration was determined upon the degree of the loss of resiliency in the skin and subcutaneous tissues, when pinched into a fold.

According to this criterion those with the least resiliency showed the highest mortality and *vice versa*, although in some cases the dehydration was entirely relieved without preventing the fatal issue. Autopsy upon 9 of the patients showed that no injury had been done to the peritoneum or any of the abdominal structures. The authors concluded that the forced ingestion of water by nasal tube deserved a more extensive trial;

that 300 c.c. probably represented a maximum for intraperitoneal injection in any infant under one year of age and that smaller amounts administered more frequently were safer for infants weighing less than 4,000 grams.

#### MODES OF INFECTION IN PYELITIS.

DR. HENRY F. HELMHOLZ, of Rochester, Minn., called attention to the fact that as yet a correlation of the clinical, pathological and bacteriological findings in pyelitis had not been established. It must be granted that examination of the urine in most instances would indicate a pathological process somewhere in the urinary tract but that was all; it could not localize the lesion. It was impossible to differentiate the different forms involving the kidney cortex, pelvis, ureter, and bladder singly or together. The pathologic anatomy of these various forms of pyelitis was not well established and did not at the present time allow us to determine the mode of infection, except in those cases marked by cortical abscesses of the kidney.

Soldin and Langer, in a study of 138 cases, were able to isolate the streptococcus lacticus in every instance in which repeated cultures were taken. In a former series of experiments by Dr. Beeler and the writer, the urine was found to be sterile in about 50 per cent. of normal patients and in 30 per cent. of the patients with parenteral infection; solid mediums were used. In the study herein reported in which liquid mediums were used, cultures were sterile in 59 of 108 instances and in solid mediums, in 75 of 108 instances. So far as bladder cultures concerned the mode of infection, they would be important only if Soldin's and Langer's premises were correct, namely, that the organisms present in the bladder always came from the kidney. Inasmuch as it was impossible under any circumstances to prove this, cultures of the bladder could not be of use in helping to solve the mode of infections, but of importance only in detecting infection of the urinary tract. By means of ureteral catheterization, an advance had been made in that we were able to determine whether the infection was in the bladder or higher. It afforded very little help in determining the mode of infection in pyelitis, but if carried out in a sufficiently large group of cases of the different types, it showed the numerical distribu-

ton of infections of the bladder and kidney and it might make possible a regrouping of cases, the features of which would differentiate cystitis from inflammation of the upper urinary tract.

To demonstrate the importance of bacteriological studies Dr. Helmholtz cited some of the pathologic studies of kidneys that were sent by members of this Society. These tissues were used to make serial sections of the pelvis of the kidney. No cultures of the different portions of the urinary tract were taken at necropsy, a matter which was of much importance. Clinically, the cases were definite examples of pyelitis; grossly and histologically they showed in serial sections an entirely normal pelvis. The pathologic report in so many cases of pyelitis was negative that it seems essential that bacteriological studies of the kidney, pelvis and bladder should be made in all cases of pyelitis that came to necropsy. These cases were so rare that only by making a group study of carefully controlled material would it be possible to reach any definite ideas with regard to the pathology. Thiemich, in his series of cases, found abscesses of the cortex of the kidney and no lesions of the pelvis and the bladder. The pyelitis most frequently observed at autopsy was that with lesions of the kidney. Studies in experimental pyelitis indicated that the pathology was different with infection through the blood than with ascending infection. A large percentage of cortical lesions was found in hematogenous infections. The inflammatory condition localized in the papillae. In cases of lesions, caused by intracystic injections the acute lesions in the pelvis were essentially in the parietal portion and the papillae were usually free. At present, this was the only feature which permitted a histological distinction of hematogenous from an ascending pyelitis. In all of the writer's experiments in which he found peripelvic inflammation, there was also found an infection of the urinary tract, as evidenced by the presence of bacteria and pus within the lumen of the pelvis. The fact that in two-thirds of the infections of the pelvis, after intracystic injections, no periureteral infiltration was found but only peripelvic inflammation and pus in the pelvis showed that here too was a histologic differentiation of the mode by which infection might travel from the bladder to the kidney. In the experimental

production of pyelitis, there was good evidence for the production of inflammatory conditions of the pelvis of the kidney, both of the hematogenous and ascending routes. The hematogenous method was very frequently associated with abscesses in the cortex of the kidney, but also in numerous instances by a simple inflammatory condition of the pelvis. There could be no question that cortical lesions of the kidney and pyelitis could be produced in the animal by the hematogenous route, by organisms of the coccus as well as of the colon group. The exact mode by which the organisms reached the pelvis of the kidney and produced inflammation was still open to question, although in all likelihood it was not by way of the usual excretory channels but by way of the capillaries of the papillæ. The demonstration of the possibility of the hematogenous route of infection did not exclude any other route of infection. With regard to the direct passage of organisms from the intestinal canal to the kidney by way of the lymphatics it did not appear that sufficient evidence had been brought forward to warrant a discussion at this time. In view of the way in which the lymphatic system developed there was a possibility of a direct connection persisting in some cases.

#### CALCIFICATION OF THE SKIN IN A CHILD.

DR. JOHN LOVETT MORSE, of Boston, reported this case. The child was of poor and ignorant parents, was full term and normal at birth. She was nursed for 8 months and then given the family diet. She walked at 13 months. When 22 months, she was sick for a week with what was called influenza. About a month later she fell from a chair and soon ceased to walk. She was admitted to the Children's Hospital in March 1919, when a little more than 2 years old. Her general nutrition was fair; she was slightly rachitic. There was eczema in both axillæ and behind the ears. The tonsils were enlarged. The hemoglobin was 59 per cent., the white count, 8,400, and the tuberculin test, negative. In May, 1919, it was noticed that there was an indurated area, the size of a lemon, dark purple-red in color, but not hot or tender, on the left buttock. This was supposed to be an absorbing subcutaneous abscess. In August, 1919, she was treated at the Boston Dispensary for ulcerations with in-

durated edges in the folds of both axillae and on both sides of the chest. These ulcerations were thought to be abscesses that had broken down. The Wassermann test was negative. The child was lost sight of for a year. Her tonsils and adenoids were removed at the Children's Hospital, October, 1920, and in November, 1920, a large furuncle of the left arm was opened. In November, 1920, when  $3\frac{1}{2}$  years old, she was admitted to the Children's Hospital, having been sick with a respiratory condition for about a week. There was at this time a dermatitis of the scalp, the teeth were bad, the tonsillar fossae showed necrotic tissue left from the tonsillectomy and there was a rachitic rosary.

Physical examination showed areas of induration at the borders of both axillae and at the left elbow, in the upper thigh, in the buttocks and in the smaller areas in the popliteal spaces and in the calves of the legs. The induration was firm and apparently in the skin and subcutaneous tissues. In some places there were numerous small hard nodules scattered through the indurated areas. The father stated that he first noticed these areas of induration a year before. The x-ray photographs of these indurated areas looked as if the tissues were filled with fine shot. The only plausible explanation seemed to be that these indurated tissues were undergoing calcification. The blood examination showed hemoglobin 80 per cent., red blood corpuscles 4,520,000; white corpuscles 23,000; small mononuclears, 43 per cent.; large mononuclears, 1 per cent.; polynuclear neutrophils 56 per cent. Other tests were negative. A small piece of tissue, including fat and fascia, was removed from the outer side of the right thigh for examination. The detailed results of microscopical examination were given. The process was interpreted as primary degeneration of fat followed by calcification and repair by a vascular organization without giant cell formation. An unusual feature was the absence of evidence of the formation of fatty acid crystals usually to be seen in fat necrosis. The product of the degenerated fat seemed in this case to be a homogeneous hyaline material in which the lime deposited. The diagnosis was necrosis of subcutaneous fat with a typical sequence and calcification. The etiology was unknown.

The history in this case suggested strongly that the changes in the skin were due to infection. The histology showed no evidence, however, that an infectious process was the cause of

the lesions in the subcutaneous fat. The microscopic appearances resembled the fat necroses found in the abdominal cavity in acute pancreatitis, where the lesion was of course due to lipolytic ferment. In spite of the difficulty in accounting for the presence of such a ferment in the subcutaneous tissue, such a possibility must be considered in this instance.

ANOMALY OF THE KIDNEY IN A CHILD, WITH  
SUDDEN UREMIA AND DEATH, AT TEN  
MONTHS. FUSION OF THREE  
KIDNEYS INTO ONE.

DR. HERBERT B. WILCOX, of New York, reported this case and presented the specimen. The child was a male infant of 10 months weighing 20 pounds, who had been well up to the onset of his present illness. He was admitted to the hospital suffering from an acute infection of the pharynx with cervical adenitis, otitis and a temperature of 105°; the white blood count was 20,000. During his 16 days in the ward, he ran the usual course of such conditions and seemed to be slowly improving. He then developed sudden abdominal distention. An indefinite mass, hitherto unnoticed, was palpated in the lower right abdomen. Edema of the lower extremities developed, with vomiting and a rise in blood pressure, and death occurred 24 hours later. Autopsy demonstrated moderate edema of the feet and ankles, a distended abdomen containing 500 c.c. of clear straw-colored fluid. The findings were otherwise negative except for the kidneys, which were represented by an irregular nodular mass located in the midline at the level of the brim of the pelvis. This mass consisted of 3 kidney elements fused together, each with a clear line of demarkation between. There were numerous cysts throughout the kidney substance and sacculations of the pelvis. The cortex,  $\frac{1}{2}$  inch in diameter, and the medulla, deeply congested, were fairly well differentiated. The capsule stripped easily. A separate pelvis was found in each kidney element, these fusing into one dilated common pelvis from which ran one large dilated ureter entering the bladder at the site normal to the right ureter. The left ureter was patent and dilated for about one-third of the distance from the kidney to the bladder and from this point extended to the bladder as a fibrous cord. The presence of 3 kidneys was a rare anomaly, but when occur-

ing represented about 4 per cent. of the anomalies in these organs. There were a few recorded cases of supernumerary kidneys. The third kidney then usually was fused with the left and occupied the position normal to the left kidney. Fusion of the kidneys of all types occurred in about one in 10,000 autopsies. Nowhere in the literature since 1900 was any report found of the occurrence of the fusion of 3 kidneys. A kidney anomaly reported by Monquiot as lying transversely across the vertebra, having 4 ureters and 4 sets of vessels, was considered as possibly an instance of the fusion of 4 kidneys. Abnormalities of renal arteries were met in about 25 per cent. of autopsies and were frequently associated with developmental defects of the kidneys and ureters. Such abnormalities as these were thought to represent a throwback or reversion to the earlier types of kidney.

#### A CASE OF DWARFISM ASSOCIATED WITH CONGENITAL HEART DISEASE.

DR. CHARLES HERRMAN, of New York, reported this case. He stated that cases of congenital heart disease, associated with marked dwarfism, were comparatively rare. In a series of 62 cases of congenital heart disease reported by Weber, only one was associated with marked dwarfism. The patient, 13 years of age, was the youngest of 7 children, all but one of whom were healthy and of normal physical and mental development. The one child was not as strong as she should have been. The family history was negative. The patient was born at full term; the delivery was non-instrumental. The patient was small but not cyanotic. She was breast fed for 8 months and began to walk at 2 years of age. She had always been small for her age and not quite as strong as the other children. At 5 years of age, she was taken to a physician on account of a cough, and the congenital heart lesion was recognized at that time. The child's mental development was normal. She had had none of the infectious diseases of childhood, save an occasional cold. She was able to walk long distances without tiring and to go up stairs slowly without becoming short of breath or cyanotic. Her appetite was fair, bowels regular. She had not begun to menstruate. The patient was markedly under size. Her weight was 49.5 pounds, corresponding to that of a child of 7



years, the normal for her age being 91 pounds. Her height was 48.5 inches, corresponding to that of a child of 8 years. The patient was not cyanotic, the fingers were not clubbed, but the hands were somewhat cool. The lungs were normal. The apex beat was felt in the fifth intercostal space, just outside of the nipple line; there was no thrill. The heart was enlarged to the right and there was an increased area of dullness in the second intercostal space to the left of the sternum. A loud systolic murmur was heard over the entire cardiac area, loudest at the third intercostal space to the left of the sternum; it was very well transmitted to the vessels of the neck on the left side, but poorly transmitted to the right side. The roentgenographic examination showed enlargement of the heart especially to the right. The ossification centers were apparently normal. The examination of the blood showed 90 per cent. hemoglobin and 5,136,000 red blood cells. The diagnosis of the exact nature of the lesions present in the congenital heart was extremely difficult. Defect in the ventricular septum, with an open ductus arteriosus, was the probable diagnosis. Almost all cases of congenital heart disease showed some retardation in growth, but usually it was not marked. The weight averaged from 10 to 15 per cent. below the normal for the age. A reduction of nearly 50 per cent. as in this case was rare. As would be expected, the patients with marked cyanosis usually showed more retardation. It was therefore all the more surprising that the dwarfism should be so pronounced in this child notwithstanding there was so little disturbance in the circulation. Although the physical examination showed no lesions in other organs, it was not unlikely that some other factor, possibly some other congenital anomaly was responsible for the marked retardation in growth.

#### A CASE OF MENINGITIS DUE TO THE STREPTOCOCCUS HEMOLYTICUS WITH RECOVERY.

DR. GEORGE N. ACKER, of Washington, reported this case, which occurred in a white boy, 12 years of age. He was sick for 10 months on account of lack of breast milk and the fact that different foods given did not agree with him. During the second winter he had an attack of bronchopneumonia, after which he was nervous and in a state of malnutrition, but was somewhat improved after the removal of his tonsils and ade-

noids. During the third year he had severe inflammation of the bowels. Between the fourth and fifth years he had measles and chicken pox, at 7 years a double mastoiditis, and 3 winters ago, a slight attack of influenza. Two winters ago he had a more severe attack with ear ache and temperature for 3 weeks. His present illness began January 14, 1921, with pains in the right ear. For 4 days he had a remittent temperature and several hemorrhages from the ear. On January 22, in the evening, he had severe headache, vomiting and pains at the end of the spine. His temperature went to  $104^{\circ}$ ; in the morning of January 23 the temperature was  $101^{\circ}$ , going to  $105^{\circ}$ , in the evening. There was hyperesthesia, photophobia, retracted head and Kernig sign present. On January 29, lumbar puncture was done. The fluid flowed by drops but rapidly, 30 c.c. being removed. It was distinctly turbid on macroscopic examination. Microscopically it was found to contain an abundance of pus cells and fibrin, and a streptococcus. Culture showed a pure culture of streptococcus hemolyticus. The lumbar puncture appeared to relieve the patient and was repeated several times. Until February 8, the temperature continued to be high at night and lower in the morning; it was difficult to take the pulse, temperature and respiration on account of the movement of the body, and the fact that the patient resisted any restraint. He was delirious at times and drowsy all the time. The head had been retracted, and pains in the head, back and legs were marked. There had been bleeding from the nose. He had taken large amounts of water and passed from 5 to 6 pints of urine daily. For several days he had nausea, vomiting and loss of appetite. Aspirin had had a good effect on the pains and bromide had been given several times daily for the nervousness. The pains gradually became less and disappeared. The boy grew stronger and at the present time was in good condition. Dr. Acker said that when he first saw the case he thought that the meningitis was secondary to the ear disease, but from the germ found he regarded it as a result of the influenza as there were many cases of the disease at that time in the city.

#### HUMAN MILKING MACHINE.

DR. ISAAC A. ABT, of Chicago, presented this apparatus which had been constructed to secure an action which resembled the

sucking action of the baby as nearly as possible. The machine was designed in such a way as to permit a variation in the intensity of the sucks and a variation in the number of sucks per minute.

The machine consisted of a pump driven by an electric motor with a coupling which could be adjusted so as to vary the number of pump strokes between 30 and 80. From the pump the suction was transmitted to a small milk-receiving chamber which had a valve at the bottom. On the suction stroke of the pump, the valve was closed and the milk drawn from the breast into the chamber. On the compression stroke of the pump, the valve was opened and the milk discharged into any desired receptacle. The intensity of the suction was adjusted by a valve located at the pump and the amount of suction exerted on each stroke could be read from the vacuum gauge which was connected with the pump. It was probable that the machine would have to be used for a few days successively before it would extract the milk with the same speed with which it could be expelled by pressure. Dr. Abt stated that experiments were being made at present with a machine which permitted of a variation of the proportion of suction period and relief period.

#### ACUTE LYMPHATIC LEUKEMIA WITH LYMPHOMATOUS CHANGES IN AN INFANT OF FIVE MONTHS.

DR. L. E. LA FÉTRA, of New York, presented this report. He said that the report was presented because although enlargement of the lymph nodes and spleen were very common in childhood, involvement of other organs was, in his experience, very unusual. The laboratory findings showed the case to be one of lymphatic leukemia. The important findings were enlargement of the thymus, enormous spleen, and involvement of the liver, kidneys, retroperitoneal glands, adrenals and practically all the viscera. The organs showed an enormous general infiltration with lymphocytosis.

#### A CASE OF ENCEPHALITIS LETHARGICA IN THE NEW-BORN.

DR. B. RAYMOND HOOBLER, of Detroit, reported this case of a baby first coming under his observation when 3 weeks old.

with the history that though apparently normal it slept for periods of 24 to 36 hours, and could hardly be aroused for its food. The baby did not cry like other babies and the mother's keen eye noted that there was an exceedingly placid expression about the baby's face. Ptosis of the left eyelid was noticed from the first day, but this was thought to be a family inheritance as some relative had a fallen lid. Shortly afterward there was considerable difficulty in swallowing. At the end of the third week, convulsions, general in character, started. These were at first very severe, ending with an agonizing cry. When first seen by the writer there was typical myoclonus. A tentative diagnosis of encephalitis was made, having also in mind the possibility of a birth injury. Various laboratory observations were conducted; an x-ray of the skull, spinal puncture, blood and urine analyses, cultures from washings of the nasal cavities, all of which were negative. The spinal fluid was not under pressure. The Wassermann was negative. The eye grounds showed a slight haziness of outline but no choked disc. The case had been under observation 9 weeks. During this time the convulsions had become much less frequent and very mild in character. Nystagmus had been resented for a few days in the seventh week. Strabismus, both convergent and divergent, were present during the first 3 weeks of the convulsive period. The ptosis, which at first was marked was now slightly noticeable. There was no longer difficulty in swallowing. The extremities had at no time shown paralysis. The knee jerks were active. During the seventh week there developed fibrillary twitchings of the eyelids, cheek muscles, and over the abdominal wall. The amount of lethargy present had varied greatly. In the ninth week of the disease, the child had seemingly recovered from its lethargy and now awakened for its feedings and often lay awake for periods as a normal infant should. All the functions had been normal and the child had gained steadily in weight and now had all the appearance of a healthy child. The mother related that during the time she was pregnant, at least during the latter half of pregnancy, she was at times so overcome with the desire to sleep that she would drop on a couch after her husband would leave in the morning and would sleep the greater part of the day. This was ascribed to biliousness and nothing was thought of it. So far as he could ascertain, Dr. Hoobler said the mother

showed none of the typical symptoms of lethargic encephalitis and only when the baby developed the symptoms was anything thought of the drowsiness of the mother during pregnancy.

#### A CASE OF RUMINATION.

DR. PERCIVAL C. EATON, of Pittsburgh, reported this case, which was admitted to St. Margaret's Memorial Hospital, May 4, 1921, at the age of 6 months. The child appeared perfectly normal at birth, and weighed 8 pounds. The child was then given a feeding of cows' milk and water, equal parts, plus the breast. At 2 months of age, the breast was discontinued. Then for a while cows' milk, water and lime water, and then barley water and milk, equal parts, the top of a quart of milk after standing being used. The baby then began spitting and regurgitating regularly and with increasing frequency. The child was then put on condensed milk and 2 days before coming to the hospital on Horlick's milk. There was constant sucking of the fingers and fists noticed on arrival at the hospital. For the first 2 days the child regurgitated all food. The bowels were constipated and the stools offensive. The child was cleaned out and put on a proper milk formula. It was found that if he laid on his side he lost all his food, but if kept on his back he did not lose nearly so much. To prevent him keeping his fingers and fists in his mouth all the time his arms were put up in splints. He still regurgitated but not so much. Upon careful observation it was noticed that he would bring food up into his mouth, sometimes spitting out a little and sometimes retaining all of it in his mouth, chew it and then swallow it. As an experiment, his hands were allowed to go free and he seemed to use them to facilitate the bringing up of his food. Thereafter his hands were kept away from his mouth and he ruminated less and less, and at the time of leaving the hospital was losing little of his food. His color had improved and on May 30 he weighed 9 pounds, 10 ounces. Dr. Eaton said he had never seen a case of this kind. In looking up the literature he found, in the February, 1921 number of the *American Journal of Diseases of Children*, an article on "Rumination," by Dr. August Strauch which was very complete, and in the May, 1921 issue of *ARCHIVES OF PEDIATRICS* he had found a similar report by Dr. Kerley.

## REPORT OF FEMALE INFANT WITH DOUBLE INGUINAL HERNIA.

DR. H. M. McCLANAHAN, of Omaha, reported the case of a child whose birth weight was 4 pounds. Pregnancy and labor were uneventful. The child's history was that when the infant was 5 weeks old the mother observed a swelling in the right groin and the following day a similar swelling in the left groin. These swellings were diagnosed as double inguinal hernia. There was no mass in the left hernia at this time. About 4 weeks later, a small round mass appeared in the left groin that could not be reduced. Operation was advised. Under general anesthesia a thin walled sac was exposed. On opening this sac it was found to contain the fallopian tube and ovary. The ovary was almost purple but not strangulated. It was returned to the abdominal cavity. The hernial sac was removed and the canal closed in the usual manner, the infant rallied from the operation and went on to recovery. The hernia on the right side was retained by a truss.

Dr. McClanahan reviewed the development of the inguinal region, gave a summary of current literature on the subject; the most comprehensive article being that of Dr. Heineck's records of 142 cases, of which 67 were under one year of age. A careful study of the reported cases revealed the fact that strangulation was due to torsion and not to constriction at the internal ring. In one case quoted where the torsion had been present for only 2 days, the ovary was strangulated. If the tube and ovary were to be saved, early diagnosis and prompt operation were necessary. In those cases where the ovary could be reduced, the probability was that it would later prolapse, hence an early operation was the better and safer treatment. A study of the history of the cases of hernia of the tube and ovary in adults revealed the fact that many of them had existed for a number of years. It was probable that all cases of hernia of the ovary and tube were due to congenital defect, even in cases where the hernia did not appear until later in life. The writer had made a careful search of modern text books. In some no reference was made to this subject at all, and but scant mention in any work had come under his observation.

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## THE CHEMISTRY OF MILK CURD MODIFICATION IN INFANT FEEDING.

BY ROBERT WOOD TERRY.

Cleveland, Ohio.

*Introduction.*—The specific intent of this article is an endeavor to explain in chemical terms the action of certain substances commonly used in artificial infant feeding to modify the character of milk curds. While medical literature has given this subject due consideration from a practical and clinical standpoint, the writer has been able to find but little theoretical explanation for the action of these substances. The data presented in this paper are based on experiments *in vitro* and the deductions and recommendations are purely theoretical and are not presented as clinical facts. For years physicians have been adding certain substances to milk to modify the character of the curds and their experience has unmistakably shown that these substances have a

beneficial action. However, this knowledge has been almost wholly empirical and it is thought that the presentation of certain theoretical facts concerning the action of these substances will help to place their use on a more logical and satisfactory basis. The suggestions regarding the use of certain substances is based only on their action as milk curd modifiers. For instance, under alkalies where certain quantities of lime water are suggested, this is done with absolute disregard to the controversy as to the necessity or advisability of the addition of more calcium to the infant's food or to its effect on fat metabolism. In this connection, as Brennemann remarks, "The ultimate test of any therapeutic measure in infant feeding is the baby himself, the living, clinical, digesting baby that often laughs at our theories and weeps over our science."

*The Object of Modification.*—The object of modifying the character of the milk curds is due to the great difference in the physical condition of these curds as obtained from human milk and cows' milk. The curd from human milk is flocculent and each individual curd is very small and in the aggregate resembling extremely fine cottage cheese in a watery condition. When cows' milk is coagulated under the same conditions, it forms in 3 or 4 large curds. In human milk, where the curd is flocculent, the gastric juice can permeate all through the curd and can form hydrochloric acid-casein, in which form the casein is digestible, and due to the antiseptic action of the gastric juice, it will be able to arrest bacterial activity and lactic acid fermentation. It is axiomatic that the more surface exposed to the gastric juice, the more rapid and thorough will be the performance of its proteolytic functions.

When through some misfortune, it becomes necessary to deprive an infant of its mother's milk, it is then necessary to feed the infant artificially; the most commonly used and logical substitute being cows' milk, and, because of the great differences, particularly in the curds of the two milks, it becomes necessary to so modify the cows' milk that the infant can digest it properly. Nature intended an infant to obtain its nutrition from milk the same as a calf but it certainly expected it to obtain it in a different physical condition as is evidenced by the differences in the curds formed under identical conditions and the more diverse difference in the anatomy of the stomachs of the two off-springs.



*Chemistry of Milk Coagulation.*—One of the most disputed questions in milk chemistry is whether the caseins from the two milks are identical. This question has arisen from the difference in the physical properties of the curds from the two milks. At the present time, the weight of scientific opinion seems to indicate that they are identical and that the difference in the curd formation is due to other concomitant factors such as the concentration of the caseinogen, acidity of the precipitation medium, the ratio of caseinogen to lactalbumin, the ratio of calcium to citric acid in the milk, etc. The casein from human milk when properly purified has the same nitrogen, phosphorus and sulphur content; the same degree of valency; gives the same series of salts with bases; has the same molecular weight; and is acted upon in the same manner as the casein from cows' milk.<sup>1</sup>

Considerable confusion exists as to the difference in the terminology of casein products used by various writers and it becomes almost imperative that each writer give a key to his articles. The product precipitated from milk by acids is termed *casein*; this term is also used in a collective or general sense. The mother substance of the curd exists in milk in colloidal suspension and is called *caseinogen*. The rennin transformation product is termed *paracasein*. The curd produced by the combined action of calcium and magnesium ions on paracasein (the normal milk curd) is termed *calcium paracaseinate*. While the term magnesium paracaseinate would be equally applicable here, it seems that the literature speaks only of the calcium salt, so that term will be used throughout this article. Rennin is a proteolytic enzyme found in the stomach of human beings and some animals and its only function appears to be that of curdling milk. Rennin from the calf's stomach is termed *chymosin*, while that from the human stomach is termed *parachymosin*. These two substances are very similar in action, but not identical. All rennin referred to in this article will be *chymosin*.

The coagulation of milk in the stomach is practically identical to its coagulation in the test tube. The time noted for the following changes that take place are those of test-tube observation, but are approximately correct for the stomach. Cows' milk appears to coagulate in the stomach in from 3 to 5 minutes. When milk is taken into the stomach and comes in contact with the gastric juice containing the enzyme rennin, the milk immediately begins

to undergo a change, the rapidity of which is dependent upon the temperature and concentration of the rennin and caseinogen. This change is not macroscopically noticeable. In about 4 or 5 minutes the viscosity of the milk begins to increase to a noticeable extent and in a few seconds it will be so viscous that it will not flow; in another few seconds small curds begin to appear. In an additional few seconds these small curds begin to cohere to form several large curds. In from 3 to 5 minutes these curds start to expel the whey by contraction. In this condition the curds are semi-rubbery and occupy a large per cent. of the original volume of the milk. The expulsion of the whey probably eliminates the bulk of the gastric juice which might happen to be enclosed when the curds first form. This is the end of coagulation and digestion proper then commences.

The coagulation of milk is accomplished by two distinct factors. The first is the proteolytic action of the rennin, that is, the conversion of caseinogen to paracasein. Caseinogen exists in milk in colloidal suspension as submicrons at the rate of from 3 to 6 billions per cubic centimeter, and appears to be combined with calcium phosphate.<sup>2</sup> According to VanSlyke & Bosworth<sup>3</sup>, caseinogen is an octobasic acid and appears to exist in milk as calcium caseinogenate (caseinogen  $\text{Ca}_4$ ). Neutral dicalcium phosphate also appears to be colloiddally suspended. In whatever condition caseinogen exists in milk, it is changed by rennin to paracasein, which substance is insoluble in the presence of sufficient calcium and magnesium ions. The velocity of this rennin activity is probably not affected by any ordinary change in the degree of acidity of the medium.<sup>4</sup> Paracasein in the presence of sufficient calcium or magnesium ions flocculates into curds. When the calcium and magnesium ions are diminished beyond a certain extent the paracasein remains in solution or suspension. The change of caseinogen to paracasein is independent of the presence or absence of calcium or magnesium ions. Experiment No. 1, which is essentially Hammarsten's<sup>5</sup> famous experiment, will clearly demonstrate the function and independent action of rennin and calcium and magnesium ions.

*Experiment No. 1.*—Two equal sized samples of cows' milk are placed in flasks in a water-bath and heated to  $38.5^\circ \text{C}$ ., which temperature is maintained throughout the experiment. To one

flask is added a certain amount of ammonium oxalate solution, which precipitates all the soluble calcium as insoluble calcium oxalate. Then to each flask is added an equal amount of fresh rennin solution. In about 5 minutes the flask holding the unaltered milk will be coagulated. Allow the other flask to remain in the bath for an additional 30 minutes to demonstrate that no coagulation will take place, then boil this milk to destroy the rennin, and add a few drops of a solution of calcium chloride; immediately a precipitate of calcium paracaseinate is produced, showing that the presence of calcium is essential for the coagulation of milk. From this experiment it will be seen that rennin is not a coagulating enzyme, but that it is a proteolytic enzyme and that the calcium is the substance that produces the coagulation. This same effect can be produced by a solution of magnesium chloride.

If the same number of paracasein particles and calcium and magnesium ions are confined in a space smaller than that of the original space and all particles in motion, it is evident that the chances of a union between the particles is greater in any given interval; and if the space be increased over the original, the chances of a union will be less in the same interval. In other words, this is the principle of the law of mass action—that the speed of a reaction is proportional to the concentration of the active masses. This is a very important fact in milk curd modification. It has been shown by Brennemann<sup>6</sup> that nascent calcium paracaseinate (true milk curds) have very powerful coalescing properties, but this property rapidly disappears. This means that if a certain number of colloidal particles of calcium paracaseinate are formed rapidly that there will be a large number of collisions while they are comparatively nascent and having powerful coalescing properties and that under these conditions large aggregates are possible. If this same number of colloidal particles are slowly liberated in the same volume, it is evident that collisions will not take place so often, but when they do take place it will be when one or more of the particles or aggregates has lost to a great extent its coalescing power and by deduction from the natural frequency of coincidence, no large aggregates are possible. Therefore, anything added to milk which delays the formation of calcium paracaseinate is a milk curd modifier because of the rapidly fleeting power of the curds to coalesce. It may be stated that the specific action of coagulation of calcium or magnesium ions on paracasein

is due to the ion giving the colloidal particle temporary cohesive properties.

The following procedures are in use for modifying milk curds and are listed not in the order of their importance, but in the most logical sequence of their presentation:

1. Dilution with water.
2. By the use of Gruels and carbohydrates.
3. By boiling the milk.
4. By the use of citrates.
5. By the use of alkalies.

*Dilution With Water.*—The theory of the action by simple aqueous dilution is based on the concentration of the active masses,—the more dilute, the more slowly are the colloidal particles formed and as explained before, they then have less coalescing power and hence numerous small curds are the result. The effect on the velocity of coagulation by dilution is given in Experiment No. 2.

*Experiment No. 2.*—

- |    |           |                    |      |          |
|----|-----------|--------------------|------|----------|
| 1. | 100% milk | coagulated in      | 345  | seconds. |
| 2. | 75% milk  | " "                | 380  | "        |
| 3. | 50% milk  | " "                | 655  | "        |
| 4. | 33% milk  | " "                | 2100 | "        |
| 5. | 25% milk  | uncoagulated after | 2    | hours.   |
| 6. | 12½% milk | uncoagulated after | 2    | hours.   |

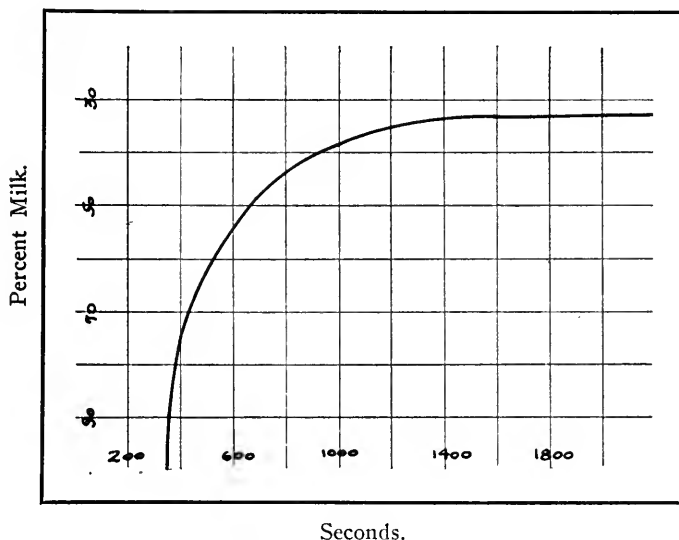
Tests No. 1 and No. 2 gave normal coagulations. While No. 3 coagulated, it was not quite complete, the whey being slightly milky. Small flakes of calcium paracaseinate appeared in test No. 4 in about 35 minutes, but after 2 hours only about 10 per cent. seemed to be precipitated. The addition of 1 mil of about a 5 per cent. solution of calcium chloride to tests Nos. 4, 5, and 6 (200 mils each), produced, immediately, beautiful floccules of calcium paracaseinate.

This data is plotted in Graph No. 1. Here, it will be noted that relatively little delay is occasioned unless the milk occupies about 50 per cent. or less of the volume of the mixture. Obviously this type of modification cannot be practiced without limit, because of the capacity of the infant's stomach. This method produces a curd of very desirable properties. The time noted here for coagu-

lation may not be the same as in the stomach, but the ratio of time to effect is the same.

Brennemann<sup>7</sup> has studied the coagulation of milk, plain and modified by various substances, in the stomach, and his contribution is very comprehensive and conclusive in experimental detail and results. He obtained the coöperation of a young adult who could empty the stomach of its contents by "digital irritation of

GRAPH NO. 1 DILUTION OF MILK WITH WATER.



the fauces". This meant delivery of the stomach contents in its actual condition, something that is not true by the use of emetics or the stomach pump. Brennemann's numerous experiments covered practically everything used for milk curd modification and it is most interesting to note that in no case except lactose, where his conclusions were drawn from inference and not experiments, did his conclusions differ from the writers, wherein all experiments were performed in "test tubes" and mechanical stomachs.<sup>8</sup> Brennemann's conclusion regarding diluted milk is, "The size of the curds varies inversely as the dilution, or directly as the amount of casein."

*Gruels and Carbohydrates.*—The substances from which gruels are commonly made are wheat flour, barley flour, rolled oats and

occasionally rice and arrowroot. In these gruels the starch is present in the gelatinous or colloidal state—the only condition in which it is capable of modifying the curd. Its action is entirely mechanical, that of interference as a protective colloid, and its effectiveness is proportional to the amount of gelatinized starch present.

In some cases, dextrinized gruels are used; these are prepared by adding some form of liquid diastase to the gruels to convert the starch to dextrins and maltose. In this condition the “starch” is more readily assimilated, but unfortunately it has lost its effectiveness and is unable to perform the function intended of it.<sup>9</sup>

One manufacturer of an infant food states that when milk is modified with his product, the curd formed occludes about 30 per cent. of the food and that this being rather soluble it is rapidly removed from the curd structure, leaving it porous. This statement has not been affirmed or denied. Brennemann's experiments on carbohydrates were allowed to remain in the stomach only from 30 to 60 minutes and his conclusions are, “Starch concoctions very radically influence the coagulation of milk in the stomach. Carbohydrates, dextrose, milk sugar, cane sugar and maltose have no appreciable influence.”

Sugars have practically no effect on the rapidity of curd formation. Table No. 1 shows the rapidity and physical condition of curd formation in milk to which various sugars have been added.

It is interesting to note that neither dextrose nor maltose have any appreciable effect on the character of the curd, while sucrose has a decided detrimental effect in that it makes the curd semi-rubbery and comparatively difficult to disintegrate. Lactose, the sugar obtained from cows' milk, has a very decided beneficial action. From this, it would seem, all other conditions being equal (purity, etc.), that lactose is the best sugar to use in increasing the carbohydrate content of cows' milk.

The velocity of the coagulation as influenced by sucrose and lactose is practically identical, whereas the character of the curds is very different. This illustrates the point that the *rapidity* of coagulation is not the *only* factor effecting the character of the curd. Each substance has its specific action on the character of curd formation independent of all other actions. However, it may be stated that, *all other conditions being identical, that the character of curd is dependent upon the rapidity of its formation.*

"The solidity of a curd produced by rennin is inversely proportional to the length of time occupied by the coagulation process."<sup>10</sup>

TABLE NO. 1. SUGARS.

*Part A. Rapidity of Coagulation of Cows' Milk as Influenced by Sugars.*

No.	Substance.	Control.	Grammes.	Seconds to Coagulate.	Average.	Per Cent.
1	Sucrose	343	5.00	380 374 365	373	108.7
2	Lactose	388	5.00	422 415 413	416.7	107.4
3	Dextrose	390	5.00	407 397 405	403	103.3
4	Maltose <sup>1</sup>	355	5.00	302 295 300	299	84.2

<sup>1</sup>The apparent accelerating action of the maltose is probably due to calcium salts; most samples contain calcium but before this could be substantiated the sample was accidentally destroyed. This matter will be cleared up at some future date.

*Part B. Effect on the Physical Condition of the Curd by the Sugars from A.*

No.	Substance.	Macroscopical Condition of the Coagulum.
	Controls	Fairly smooth and fairly easily disintegrated
1	Sucrose	Smooth and semi-rubbery
2	Lactose	Semi-flocculent and very easily disintegrated
3	Dextrose	Fairly smooth and fairly easily disintegrated
4	Maltose	Smooth, but not so easily disintegrated.

*Notes:* Control test is plain cows' milk; the number under "Control" is the number of seconds to coagulate the control test or 100%.

Each test consisted of 200 mls of cows' milk to which 5 mls of 0.5% rennin solution was added. Rennin 1-30000.

Temperature 37-39°C.

Each test bottle was given a slight inverted motion to simulate in a manner the peristaltic movements of the stomach.

*Boiling.*—Boiling milk decidedly effects its coagulation; the curds form slowly and are very flocculent and easily digested. It has been shown<sup>11</sup> that rennin coagulation in milk previously heated to 70° C. and cooled, is not delayed; but if the milk is heated beyond this temperature, delay in coagulation occurs somewhat in proportion to the degree of heat and the length of exposure. This has been attributed to milk enzyme destruction which happens to commence at about 70° C., but from experiments conducted the writer is led to believe that milk enzymes have nothing to do with coagulation. The writer noticed that the formation of scum on milk commences at about 70° C. Certain factors increase the amount of scum formation such as the degree of heat, length of

exposure and movement of the liquid which presents new surfaces to the air, etc. Milk scum is rich in calcium salts, so that it would seem that the retarding effect on the coagulation of milk by boiling is due to the removal of calcium in the scum. The following experiment will demonstrate these facts:

*Experiment No. 3.—*

1. 200 mls milk, 5 mls rennin solution, 38.5° C.  
Coagulated in 380 seconds.  
Curd normal.
2. 200 mls milk, boiled for 10 minutes and rapidly cooled;  
strained through cheese cloth; 5 mls rennin solution,  
38.5° C.  
Coagulated in 1720 seconds.  
Finely flocculent.
3. 200 mls milk, heated as above with about 0.10 gramme  
calcium chloride in solution added after cooling; 5 mls  
rennin, 38.5° C.  
Coagulated in 255 seconds.  
Semi-rubbery.

This removal of calcium salts by the scum causes a slower coagulation due to the decrease in the concentration of calcium and if approximately this amount of calcium is added, coagulation takes place normally.

It is evident from these facts that correctly pasteurized milk will coagulate in the same time as raw milk.

Boiling the milk reduces its potential acidity from 18 to 14 degrees. This is due principally to the loss of dissolved carbon dioxide.

*Citrates.*—Citrates are employed very extensively in England for modifying curd formation, but their use is rather limited in America. The effect is all that could be desired of a milk curd modifier and there can be no objection to their use on the grounds of introducing a foreign substance to the milk as citrates are normal constituents of both human and cows' milk.

Jerome Alexander<sup>12</sup> explains the action of sodium citrate as a protective colloid and states that "when going into solution actually exhibits actively moving ultramicros in the ultramicroscope, a fact which indicates its colloidal condition."



Another theory that has been advanced is that the citrate reacts with the hydrochloric acid of the gastric juice to form sodium chloride and citric acid, which is a comparatively weak acid in relation to hydrochloric. Since the effect of citrates are observable in test tube experiments where neither gastric juice nor hydrochloric acid are present, obviously this is not the explanation for their action.

The theory that is proposed by Van Slyke and Bosworth<sup>13</sup> is: "The addition of sodium citrate to normal milk increased the amount of soluble calcium in the milk, this increase resulting from a reaction between the calcium caseinate of the milk and sodium citrate, by which is formed sodium caseinate (or calcium sodium caseinate) and calcium citrate. The reaction is reversible."

According to their theory, it is the calcium paracaseinate which is insoluble or when it is formed the milk coagulates. Calcium paracaseinate ( $\text{Ca}_2\text{paracasein}$ ) is insoluble and is the normal milk curd. Sodium paracaseinate ( $\text{Na}_4\text{paracasein}$ ) and calcium-sodium paracaseinate ( $\text{Ca Na}_2\text{paracasein}$ ) are soluble by reason of the sodium they contain. When the amount of sodium becomes less than that present in calcium-sodium paracaseinate, the paracasein compound becomes insoluble and coagulation becomes possible.

If this theory were correct, we would expect a citrate to entirely prevent coagulation if it retarded it at all, because the sodium which renders the compound soluble should be active for any reasonable length of time. Experiments show that this is not the case. Also, if it is the sodium of the sodium citrate which renders the paracasein compound soluble, why would not any sodium salt have the same effect.

Table No. 2 shows the effect on the rapidity of coagulation of milk by the use of citrates, acetates, tartrates and chlorides of sodium and potassium and it will here be seen that the citrates are the only salts that have any marked influence on the rate of coagulation. Any marked difference in the degree of ionization of two calcium salts would cause the equilibrium to be established where in the one case there would be more available calcium than in the other. The equilibrium of a reaction is always shifted towards the formation of the slightly ionized compound.<sup>14</sup> If the calcium chloride formed by the equilibrium after the addition of sodium chloride is ionized to a greater extent than the calcium citrate formed by the rearrangement after the addition of sodium

citrate, then less sodium would be available for combination with the caseinogen. It does not seem reasonable, however, that this

TABLE NO 2. ALKALI SALTS OF ORGANIC ACIDS AND CHLORIDES.

*Part A. Rapidity of Coagulation of Cows' Milk as Influenced by Acetates, Chlorides, Citrates and Tartrates.*

No.	Substance.	Control.	Grammes.	Seconds to Coagulate.	Average.	Per Cent.
1	Pot. Citrate	254	0.100	389 370 375	378	148.8
2	Sod. Citrate	305	0.100	478 460 480	472.7	155
3	Pot. Acetate	390	0.100	395 390 397	394	101
4	KNa Tartrate	372	0.100	380 380 390	383.3	103
5	Sod. Chloride	270	1.00	315 315 315	315	116.7
6	Pot. Chloride	345	1.00	370 370 365	368.3	106.7
7	Cal. Chloride	280	1.00	50 52 58	53.3	19
8	Mag. Chloride	282	1.00	101 119 103	107.7	38.1
9	Amm. Chloride	285	1.00	265 273 283	273.7	96

*Part B. Effect on the Physical Condition of the Curd by Acetates, Chlorides, Citrates and Tartrates.*

No.	Substance.	Macroscopical Condition of the Coagulum.
	Controls	Fairly smooth and fairly easily disintegrated.
1	Pot Citrate	Fairly smooth and fairly easily disintegrated.
2	Sod. Citrate	Slightly flocculent and easily disintegrated.
3	Pot. Acetate	Coarse and rubbery.
4	KNa Tartrate	Fairly smooth and fairly easily disintegrated.
5	Sod. Chloride	Fairly smooth and semi-rubbery.
6	Pot. Chloride	Smooth and fairly easily disintegrated.
7	Cal. Chloride	Smooth and fairly easily disintegrated.
8	Mag. Chloride	Smooth and rubbery.
9	Amm. Chloride	Smooth and semi-rubbery.

*Notes:* For general notes see Table No. 1.

Calcium chloride refers to  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ . Magnesium Chloride  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ . Whey expulsion from the potassium chloride tests was slow.

theory alone would explain the marked difference in the action of these two salts.

The writer's theory of the action of citrates is based on the fact that solutions of calcium citrate are but slightly ionized<sup>15</sup> and that if sodium or potassium citrate is added it combines with the bulk of the available calcium to form the slightly ionized calcium citrate; this means a diminution of calcium ions by fixation

and the concentration of one of the active masses is thereby reduced and hence coagulation takes place slower. This demonstrates that it is the calcium ion that is active in coagulation and that molecular calcium, such as calcium citrate, has but little effect on coagulation. As far as availability for coagulation is concerned it might as well be precipitated out of solution. This theory explains every known condition of the action of citrates in experimental work and is in harmony with the theoretical action of all other modifying agents.

By examination of Table No. 2 it is noted that sodium citrate has slightly greater retarding power than the potassium salt. The sodium salt contains more citrate radical per gramme than the potassium salt, but the ratio is greater than their retarding action on coagulation. Potassium acetate has practically no retarding influence on coagulation, yet the curd is coarse and rubbery; here again is the specific action probably of the acetate radical. The tartrate has apparently no action and the chlorides of potassium and sodium have little retarding effect, although sodium chloride had a slight detrimental effect on the character of the curd. Both calcium and magnesium chlorides greatly accelerated the coagulation. The calcium chloride acted about twice as fast as the magnesium chloride, but the curd produced was not very much different from the control milk curd, while the magnesium chloride curd had very undesirable properties. This would indicate that the specific action of calcium salts is far better than that of magnesium salts on the physical condition of the curds.

Citrates slightly reduce the potential acidity of the milk; this is due to the increased solubility of calcium phosphate in citrate solutions or to the formation of sodium phosphate which hydrolyzes alkaline.<sup>4</sup>

The addition of 2 grains of sodium citrate to the ounce of milk, which is the proportion usually recommended, will prevent practically all coagulation of milk in the stomach.

Brennemann's conclusions in regard to the action of citrates are that "sodium citrate has a very marked influence on casein coagulation, both delaying and altering it".<sup>7</sup>

*Alkalies.*—Of all the methods used for curd modification, alkalies have by far been given preference. In this connection, Brennemann has aptly stated that "It is gratifying to note that a

procedure that has enjoyed so many years of confidence should seem to have a rational as well as an empirical basis".<sup>7</sup>

About the only statement explaining the action of alkalies that the writer can find in medical literature is that they reduce the acidity of the milk. This is certainly true, but it is an indirect statement and not an explanation. All alkalies act by precipitating calcium salts<sup>10</sup> and when precipitated they are not capable of reacting with the paracasein and we have a reduction of potential calcium ionization or available calcium. The alkalies generally employed are sodium and potassium bicarbonates, milk of magnesia and lime water.

*Sodium Bicarbonate.*—This substance, although formerly used extensively, has of late years fallen into disuse. For the quantitative effect of sodium bicarbonate and other alkalies see Table No. 3. It will be noted that on the same alkalinity basis sodium bicarbonate has less retarding effect than any of the other alkalies. This is due to the action of the dissolved carbonic acid; liberated from the bicarbonate by the acid phosphates of the milk; on the secondary calcium phosphate probably forming a very unstable double salt of calcium (soluble) ( $\text{Ca.H}_2\text{PO}_4\text{.HCO}_3$ ) analogous to the formation of calcium bicarbonate. This means an increase of available calcium. Experiment No. 4 will demonstrate this action:

*Experiment No. 4.*—

1. 200 mls milk, 5 mls rennin solution at 38° C.  
Coagulated in 450 seconds.  
Curd—normal.
2. 200 mls milk, saturated with carbon dioxide by passing the gas in a steady stream through the milk; chilled by ice for 20 minutes just previous to coagulation; 5 mls rennin solution at 38° C.  
Coagulation in 90 seconds.  
Curd—small and rubbery.

Further verification of this action can be noted by just neutralizing a weak solution of calcium hydroxide (sucrose) with phosphoric acid; phenolphthalein as indicator; chilling this moderately and passing a stream of carbon dioxide through this magma; filtering and passing a stream of carbon dioxide-free air through the

filtrate; in a few minutes the filtrate will become cloudy due to the precipitation of calcium phosphate by the removal of the loosely held carbonic acid.

TABLE NO. 3. HYDROXIDES AND BICARBONATES.

*Part. A. Rapidity of Coagulation of Cows' Milk as Influenced by Hydroxides and Bicarbonates.*

No.	0.100 V. S.	Control Mils.	Seconds to Coagulate.			Average.	Per Cent.
1	Sod. Hydroxide	378	7.46	920	928	925	924.3 244.5
2	Pot. Hydroxide	376	7.46	975	965	950	963.3 256.2
3	Amm. Hydroxide	380	7.46	903	865	880	882.7 232.3
4	Mag. Hydroxide <sup>2</sup>	367	7.46	640	625	630	631.7 172.1
5	Calc. Hydroxide	291	16.43 <sup>1</sup>	448	443	440	443.7 152.4
6	Sod. Bicarbonate	345	7.46	425	418	423	422 122.3
7	Pot. Bicarbonate	400	7.46	502	515	502	506.3 126.6

*Part B. Effect on the Physical Condition of the Curd by Hydroxides and Bicarbonates.*

No. Substance. Macroscopical Condition of the Coagulum.

	Controls	Fairly smooth but not so easily disintegrated.
1	Sod. Hydroxide	Semi-flocculent and very easily disintegrated.
2	Pot. Hydroxide	Semi-flocculent and very easily disintegrated.
3	Amm. Hydroxide	Semi-flocculent and very easily disintegrated.
4	Mag. Hydroxide	Fairly smooth and fairly easily disintegrated.
5	Calc. Hydroxide	Fairly smooth and fairly easily disintegrated.
6	Sod. Bicarbonate	Smooth and fairly easily disintegrated.
7	Pot. Bicarbonate	Fairly smooth but not so easily disintegrated.

Notes: For general notes see Table No. 1.

<sup>1</sup>Equivalent to 7.46 mils NO. 100 V. S.

<sup>2</sup>Magnesium Hydroxide in suspension.

Solutions standardized with methyl-orange as indicator.

Both Brennemann<sup>7</sup> and Southworth<sup>17</sup> have noted the excessive liberation of gas in the form of eructations from milk modified with bicarbonates; this is due partly to the dissolved carbon dioxide and partly to the unstable compound above referred to, breaking down by heat and liberating carbonic acid.

The effect on the potential acidity of milk by sodium bicarbonate is as follows:

100 mils milk—18.5° acidity and 0.100 NaHCO <sub>3</sub>	13.1° acidity
100 mils milk—18.5° acidity and 0.100 NaHCO <sub>3</sub> after reaching 38°C.	13.1° “
100 mils milk—18.5° acidity and 0.100 NaHCO <sub>3</sub> 20 minutes at 38° C.	11.4° “
Phenolphthalein indicator.	

This decrease of acidity by heat is due to the decomposition of the sodium bicarbonate with the formation of normal sodium carbonate. For this reason, if milk is to be pasteurized or sterilized and modified with sodium carbonate, the bicarbonate must be added after cooling, otherwise the mixture will be strongly alkaline.<sup>18</sup>

*Potassium Bicarbonate.*—Whatever applies to sodium bicarbonate applies equally as well to the potassium salt. From Table No. 3 it will be seen that the quantitative effects are practically identical. Potassium bicarbonate seems to be more stable in solution than the sodium salt, although both change alkalinity on standing or heating. In precipitating calcium salts (reducing the acidity of milk) bicarbonates act according to the following equation:  

$$2\text{NaHCO}_3 + \text{Ca}(\text{H}_2\text{PO}_4)_2 = \text{CaHPO}_4 + \text{Na}_2\text{HPO}_4 + 2\text{H}_2\text{CO}_3$$
There are so many disadvantages to the use of bicarbonates that their employment should be discouraged and abandoned.

*Sodium and Potassium Carbonates.*—No data can be found where these salts have been used except in proprietary malt foods. On purely theoretical grounds, their use would be better than the corresponding bicarbonates because they will not increase in alkalinity on standing. If their use is thought desirable, it is recommended that nothing but sodium carbonate monohydrated be used as this is the only salt the physician may expect to be dispensed in a uniform manner.

*Hydroxides.*—The commonly used hydroxides are lime water and milk of magnesia. Sodium and potassium hydroxides could just as well be used and even ammonia water. The main difficulty regarding the use of the three latter substances is due to the lack of uniformity in dispensing such unstable products. This practical point has been demonstrated by analyses of solutions purchased for this purpose. From the analyses, it is certain that if a physician desires to use either sodium or potassium hydroxide that he must be assured the product dispensed is *assayed and adjusted to a definite standard*, preferably a 1 per cent. solution. Because of the

apparent usefulness of these products, definite figures will be presented for those who desire to use them.

The use of alkalies has been on a very irrational basis. Most physicians add certain quantities of alkalies on a percentage basis of the total milk mixture regardless as to whether it is whole milk or diluted milk.<sup>18, 19</sup> In some cases this method has resulted in the use of equal volumes of lime water and milk. While it is true that the modification of milk with alkalies, as has been practiced in the past, has been in most cases successful, their use on a definite basis would bring even happier results and would certainly clarify clinical data in this respect.

The use of alkalies has been based on the difference in acidity of cows' milk and human milk, cows' milk being about 6 times as acid as human milk. Human milk has 3 degrees acidity while cows' milk has on an average 18 degrees acidity. A degree of acidity is equivalent to 1 mil of normal acid per litre. By the use of the following equations, a physician will be able to feed a milk mixture of any desired degree of acidity.

*Sodium Hydroxide.*—Sodium hydroxide neutralizes milk and precipitates calcium salts according to the equation

$$\text{Ca}(\text{H}_2\text{PO}_4)_2 + 2\text{NaOH} = \text{CaHPO}_4 + \text{Na}_2\text{HPO}_4 + 2\text{H}_2\text{O}$$

1.92 minims of a 1 per cent. sodium hydroxide w/v solution will reduce the acidity of 1 fluidounce of milk 1 degree. If it is desired to reduce 16 fluidounces of milk to 3 degrees, multiply the number of minims that will reduce 1 fluidounce 1 degree by the number of degrees to be reduced and by the number of ounces of milk; thus—(15 degrees acidity to be reduced):

$1.92 \times 15 \times 16 = 461$  minims 1% NaOH solution required.

In reducing the acidity of diluted milk mixtures, the above equation is not applicable because water added to milk will reduce the acidity of the mixture by simple dilution. Because this acidity reduction by dilution deviates from the mathematically calculated acidity, a correction factor must be introduced. These factors are derived from graph curves in an article by the writer in the *Journal of the American Pharmaceutical Association*, July, 1919, and those required will be enumerated in this article as needed.

The equation for diluted milk mixtures is:

$$\left( \frac{m \times 18}{m + w} \right) \times \text{factor} - 3 = d$$

$d(m+w)1.92 =$  minims 1% NaOH solution to add.

$m$  = number of fluidounces of whole milk, top milk or cream in formula.

18 = degrees of acidity of whole milk, top milk or cream in formula.

$w$  = number of ounces of water or gruels in formula.

Factors for Sodium Hydroxide—

*Factor*

If the milk occupies about 75% of the volume of the mixture 0.96

If the milk occupies about 60% of the volume of the mixture 0.93

If the milk occupies about 50% of the volume of the mixture 0.91

If the milk occupies about 33% of the volume of the mixture 0.86

If the milk occupies about 25% of the volume of the mixture 0.84

In all but clinical experimentation these factors can be disregarded.

3 = number of degrees of acidity of finished milk mixture desired; if 6 degrees acidity are desired, 6 is substituted for the 3, etc.

$d$  = number of degrees of acidity to be reduced.

*Example*—It is desired to reduce a mixture of  $\frac{1}{2}$  pint of milk and  $\frac{1}{2}$  pint of water to 5 degrees acidity.

$$\left( \frac{m \times 18}{m + w} \right) \times \text{factor} - 5 = d$$

$$\left( \frac{8 \times 18}{8 + 8} \right) \times 0.91 - 5 = 3.19 \text{ degrees (practically 3.2)}$$

$d(m+w)1.92 =$  minims of 1% NaOH solution to be added.

$3.2 \times 16 \times 1.92 = 98$  minims of 1% NaOH solution to be added.

The acidity of milk of individual cows may vary somewhat from 18 degrees, but the writer has titrated hundreds of samples of market herd milk and has not found any samples outside the limits of 16.5 to 19 degrees. The literature reports milks varying in acidity over a wide range, but from the writer's experience he is led to believe this is due to a lack of uniformity in the methods used by the different chemists. Factors that do not affect an ordinary titration vitally affect a milk acidity titration. This matter was taken up in technical detail by the writer in a former article.<sup>4</sup>

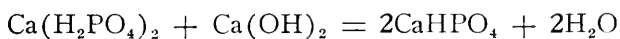
*Potassium Hydroxide.*—All that applies to sodium hydroxide applies equally as well to potassium hydroxide. 2.69 minims of a 1 per cent. potassium hydroxide w/v solution will reduce the



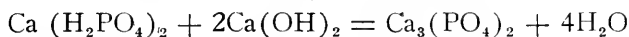
acidity of 1 fluidounce of milk 1 degree. Factors for potassium hydroxide are practically identical to those for the sodium hydroxide. All the other values of the equations are the same.

*Ammonia Water.*—No figures are given as it is thought desirable to use other hydroxides. Attention is called to the slightly less retarding effect of ammonia water as compared to sodium and potassium hydroxides (Table No. 3); this is due to the acid hydrolysis of the ammonium salts. See Table No. 2 and compare ammonium chloride to potassium and sodium chloride.

*Lime Water.*—This time honored pharmaceutical equals, if not exceeds, in popularity, milk of magnesia for milk curd modification. It seems paradoxical that if we desire to reduce the calcium-ions in milk that this is actually accomplished by the addition of further calcium in the form of lime water. However, it is not the calcium of lime water but the *hydroxyl* that functions here. This action is as follows:



or



This shows that lime water acts as all other alkalies by precipitating calcium which reduces the concentration of one of the active masses required for coagulation.

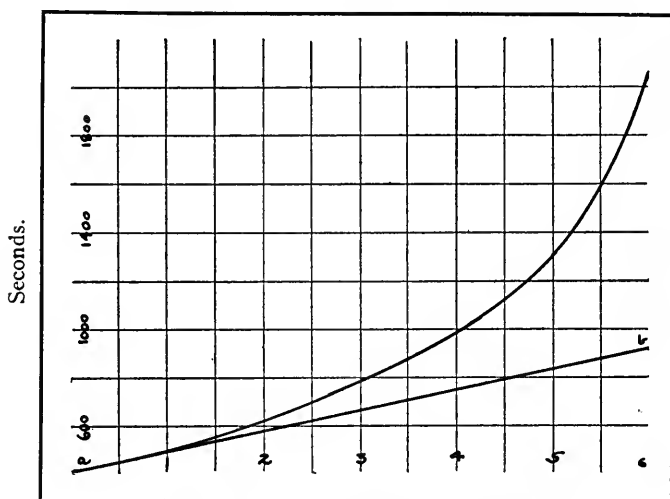
Since lime water contains only about 1/6 of 1 per cent. calcium hydroxide, its proper use necessitates a rather large volume and this is the chief objection to lime water. It is reduced in strength by the carbon dioxide in the air, but has little action on glass vessels. In this particular it is far superior to sodium or potassium hydroxide solutions. Lime water is more uniform in composition and its action is more definite than any alkali used at the present time, milk of magnesia included. For the quantitative effect of lime water see Table No. 3; this shows that about one-half ounce is equivalent to one and one-half grains of either sodium or potassium citrate.

A solution of calcium hydroxide was used assaying 1.357%  $\text{Ca}(\text{OH})_2$  w/v;\* this was used to study the action of calcium hydroxide in a more concentrated form. For the effect on milk coagulation of progressively increasing amounts of this solution see Graph No. 2.

\* Calcon.

Dr. T. Wood Clarke of the Rockefeller Institute has contributed a very comprehensive paper on the effect of certain modifying agents on the gastric digestion of infants.<sup>20</sup> Dr. Clarke experimented on babies by feeding various mixtures and pumping the stomach after set intervals and analyzing the contents. His

GRAPH NO. 2 RATE OF COAGULATION.



Mils Calcium Hydroxide Solution.

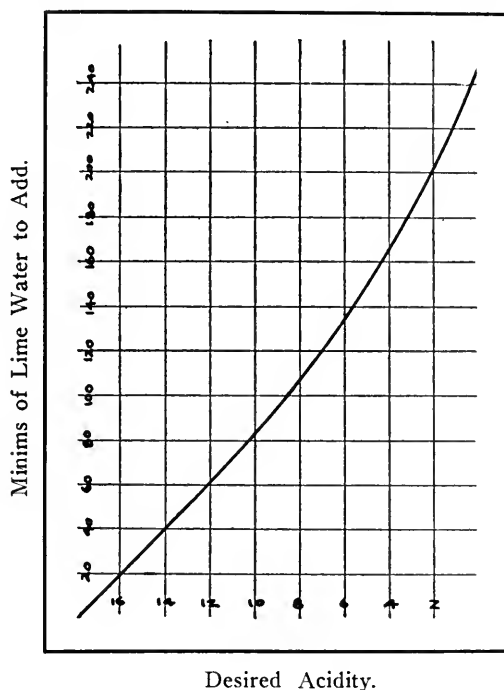
## Notes:

Milk: mixed herd.  
 Specific gravity at 15° C.....1.034  
 Fats . . . . .3.9%  
 Acidity . . . . .16.7 degrees.  
 Rennin: 0.5% solution of 1-30000.  
 Calcium hydroxide solution: Calcium hydroxide (sucrose) solution assaying 1.357%  
 $\text{Ca}(\text{OH})_2$ ; this minimizes aqueous dilution.  
 a-b: Mathematical retardation.

conclusions in regard to lime water are as follows: "Lime water itself appears not to act as is generally accepted in practical pediatrics, by reducing the acidity of the child's stomach. While unquestionably neutralizing a portion of the hydrochloric acid, the alkali stimulates a further secretion of gastric juice." This is certainly true of lime water *itself* (unaccompanied by milk) but it certainly is not true in regards to milk containing lime water. From 5 to 10 per cent. of milk mixtures usually consist of lime water and there can be no free calcium hydroxide present in such mixtures to act on the gastric juice as such mixtures are still quite acid. Fifty-one per cent. of lime water (0.163%  $\text{Ca}(\text{OH})_2$ ) is required to neutralize, not alkalinize, fresh cows' milk. The

stomach strives to maintain a certain normal degree of acidity during digestion and if we feed a food less acid than the contents of the stomach, this momentarily reduces the acidity by simple dilution and then the stomach secretes more acid to maintain its

GRAPH NO. 3 LIME WATER AND COWS' MILK.



normal acidity. Hawk<sup>21</sup> has shown in this manner that even water will stimulate the flow of gastric juice proportional to the amount of water ingested.

Lime water does not delay the coagulation of milk quite as much as does milk of magnesia, but the character of the curds formed in each case seems to be identical. Brennemann<sup>7</sup> concludes in respect to lime water—"Subjectively they (the curds) are described as 'the softest yet' and the returned stomach contents were said to have a very sweet taste that was present in no other experiment. The curds of milk to which lime water has been added would thus seem on account of its thin ribbon like, porous character, to be a peculiarly favorable one for the action

of the digestive juices." In this connection Helmick states that he believes the reason some physicians fail to obtain satisfactory results with lime water is that they do not use it in sufficient quantities.

Because of its bulkiness compared to its alkalinity, lime water reduces the acidity of the milk by both simple dilution and chemical action. Due to this double action one cannot calculate the amount of lime water required except by the use of experimental data plotted in the form of graph curves. Graph No. 3 gives the number of minims of lime water necessary to *add to* 1 fluid ounce of undiluted whole milk to reduce the acidity of the *resultant mixture* to the desired degree of acidity.

*Example.*—16 ounces whole milk are desired to be reduced to 12° acidity. The chart shows that it requires 62.4 minims for 1 ounce; therefore,  $62.4 \times 16 = 998$  minims of lime water to be added. This gives a total volume of 18 ounces of 12° acidity.

When lime water is used in diluted milk formulas, the equations given under sodium hydroxide for diluted milk are used by substituting the lime water values for the sodium hydroxide values. 15.0 minims of lime water (based on 0.163%  $\text{Ca}(\text{OH})_2$ ) will reduce the acidity of 1 fluidounce of cows' milk 1 degree.

#### Factors for lime water:

*Factor*

If the milk occupies about 75% of the volume of the mixture	0.96
If the milk occupies about 60% of the volume of the mixture	0.94
If the milk occupies about 50% of the volume of the mixture	0.92
If the milk occupies about 33% of the volume of the mixture	0.77
If the milk occupies about 25% of the volume of the mixture	0.71

*Milk of Magnesia.*—For its quantitative action see Table No. 3. The alkalinity of milk of magnesia is due to magnesium hydroxide in suspension. The fact that the active substance is in suspension and not in solution is the chief objection to this product. This explains its somewhat sluggish action. It is axiomatic that the more surface of the magnesium hydroxide exposed to the milk, the more quickly they will react with each other.<sup>22</sup> This is the reason that the more colloidal the magma is, the more desirable it is for this purpose.

Although there is a standard for this product in the pharmacopoeia, manufacturers seem to pay little attention to it. The pharmacopoeia permits a variation of 6.5% to 7.5%  $\text{Mg}(\text{OH})_2$ .

Actual analyses of the most widely sold brands, and products from the most reliable pharmaceutical houses vary from 5.22 to 9.79 per cent.<sup>23</sup> It is evident then, that a physician can never be certain of uniformity of milk of magnesia not even by using only one brand, although the variation in strength in this case, may not be as great as the above figures.

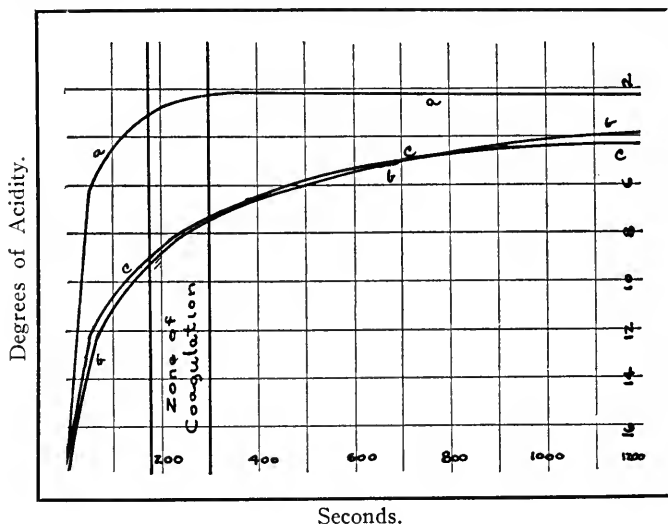
The ideal milk of magnesia for milk curd modification is a product containing a definite amount, between 1.5 and 2 per cent. of magnesium hydroxide and so precipitated that the particles are almost colloidal in size. Such a product is a thick, translucent, viscous fluid which shows little water separation on long standing. The time will come when such a product as this will be demanded by the physicians and the public in preference to our present day magmas.

Graph No. 4 shows the activity of such a product compared to a well known proprietary brand and a standard pharmaceutical house product. It will be noted that this semi-colloidal product practically assumes maximum activity in about 300 seconds as compared to about 900 seconds for the other brands. As milk coagulates in the stomach in from 3 to 5 minutes, milk of magnesia should be made so as to exhibit as much alkalinity as possible in this interval. In these graph tests, all the magmas were mixed with the milk in the proportion to obtain 3 degrees acidity; this condition will probably not be reached in the case of the two market brands for about 5 hours whereas the semi-colloidal magma has reached it in about 300 seconds. Where a day's feedings are mixed at one time, this sluggish action is negligible except on the first feeding, because after that, sufficient time has elapsed for the reaction to take place. Quite a large number of mothers feed the infants on extemporaneously made mixtures and in this case this condition becomes important. In this connection the writer does not want to be understood as condemning the present day magmas as being inefficient; quite the contrary, they are efficient, but the point desired to be made is, that a magma made in a more colloidal condition would be more efficient and give better satisfaction generally.

It would seem from the wide variation in strength and its sluggish action that milk of magnesia could be much better substituted by one of the soluble alkalies, such as potassium or sodium hydroxide or lime water. The only case where this would

not be feasible is where the physician wants a laxative as well as an alkaline effect.

GRAPH NO. 4 VELOCITY OF MILK OF MAGNESIA ACTION.

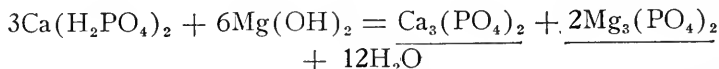
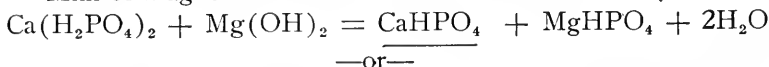


Notes:

- a: Semi-colloidal magma.
- b: Proprietary brand.
- c: Pharmaceutical house product.

Zone of Coagulation: Approximate interval of time for milk to coagulate in stomach under normal conditions.

Milk of magnesia neutralizes milk as follows:



The apparent weakness of lime water and milk of magnesia as compared to sodium and potassium hydroxides (Table No. 3) is due to the fact that a larger quantity of N/10  $\text{Ca}(\text{OH})_2$  is required than of N/10  $\text{NaOH}$  to neutralize milk. For the explanation of this phenomenon, see reference No. 4.

For the quantitative effect in reducing milk acidity, the equations under sodium hydroxide, both for whole and diluted milk, are correct for milk of magnesia after substituting the milk of magnesia values for the sodium hydroxide values. 0.236 grain milk of magnesia 7%\* will reduce the acidity of 1 fluidounce of cows' milk 1 degree.

\*By calculation the figures for any strength magma may be obtained.

## Factors for Milk of Magnesia:

Factor

If the milk occupies about 75% of the volume of the mixture 0.90  
 If the milk occupies about 60% of the volume of the mixture 0.84  
 If the milk occupies about 50% of the volume of the mixture 0.80  
 If the milk occupies about 33% of the volume of the mixture 0.77  
 If the milk occupies about 25% of the volume of the mixture 0.69  
 In clinical observations, milk of magnesia must be weighed as the error in measuring is quite considerable. This is impracticable for the mother at home; here, a weaker product, such as the semi-colloidal magma, would lessen the error from inequalities of measurement.

In connection with milk of magnesia, I cannot help but make a therapeutic trespass and call attention to the so-called calcium-magnesium balance in the body. It seems that the quantity of calcium and magnesium in the system is a constant and if we increase the consumption of one, we automatically diminish the other. In this connection, Benedict says "that magnesium forces calcium from the system and hinders the calcium retention necessary for bone building. This might be a highly undesirable effect from the repeated administration of milk of magnesia to infants."<sup>24</sup>

## SUMMARY.

1. The object in modifying cows' milk is due to the great difference in the physical condition of the curds from it and human milk.
2. The caseins from the two milks probably are identical.
3. Milk is coagulated by the combined action of rennin and calcium-ions, each acting independent of the other.
4. Freshly formed curds have a powerful cohesive property, which property is rapidly discharged.
5. Diluting the milk with water modifies the curd by decreasing the concentration of the active masses.
6. Gruels or cereal decoctions act as protective colloids by virtue of the gelatinized starch present.
7. Sugars, except lactose, have little action on the character of the curd. Lactose seems to favorably modify it.
8. Boiling the milk profoundly alters the character of the curd by the removal of calcium salts by scum formation.
9. Citrates modify milk curd formation by fixation of calcium-ions.

10. All alkalies act by precipitating calcium salts; thereby reducing the concentration of one of the active masses.

11. Sodium or potassium hydroxides are desirable modifying agents but their purchase must be attended with care.

12. Lime water acts like all other alkalies by precipitating calcium. The curd from lime water has very desirable properties.

13. Milk of magnesia has practically the same effect on curd formation as lime water, but its action is slower.

No single method of modification produces the *ideal* curd. This can only be accomplished by a combination of dilution to the proper caseinogen concentration, the addition of a citrate to establish the correct calcium-citrate ratio, the adjustment of the mineral constituents, the addition of an alkali to reduce the acidity and properly stimulate gastric secretion, and by the addition of a protective colloid to establish the correct casein-lactalbumin ratio.

Before these combinations can be studied, certain mechanical defects in artificial stomachs must be overcome and then the data obtained can be applied to clinical experimentation and then simplified for practical application. Until these matters are solved, the modification of milk coagulation will remain as it is on an unscientific and unsatisfactory basis.

In conclusion the writer desires to express his appreciation to Dr. Arthur G. Helmick of Columbus, Ohio, for many helpful suggestions and information regarding clinical experiences.

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## SOCIETY REPORT

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### SECTION ON DISEASES OF CHILDREN, AMERICAN MEDICAL ASSOCIATION\*

DR. FRANK C. NEFF, OF KANSAS CITY, MO., IN THE CHAIR.

DR. FRANK C. NEFF, in his chairman's address, urged that an effort be made to create a complete roster of the membership of the section so that its work might be made available to all those interested in questions pertaining to children. At present only a limited number of the papers read before the section could be published in the Journal of the American Medical Association, and thus many valuable papers were lost to the members which might reach them if they were enrolled with the section; all those enrolled would receive reprints of the papers read before the section. Such a list of the members of the section would enable the officers of the section to gain more information as to the work being done throughout the country. This would enable them to provide more interesting programs and to avoid the repetition of subjects unless some definite progress had been made in those particular lines. Papers should be sent to the section officers at least 3 months before the time of the annual meeting. This would permit the officers to make a selection, and the papers returned could sometimes be presented at a future meeting. Guests from foreign countries, interested in child welfare work and diseases of children, should be invited to contribute to the program. There were now many young men capable of doing research work who had too little time and money to permit them to follow their inclinations to pursue such lines of work. In order to give such men an opportunity for doing research work that would be of value to the pediatricist and to the profession at large, a project was under consideration looking to the establishment of a fund to be known as the Abraham Jacobi Pediatric Fund. It was proposed that subscriptions to this fund be voluntary and that an executive secretary should be custodian of the fund. This fund should also be used for the publication and dissemination of reprints of the proceedings of the section.

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\*Seventy-second Annual Session held at Boston, June 6-10, 1921. Detailed report specially made for Archives of Pediatrics.

## THE RELATION OF POSTURE TO THE HEALTH OF THE CHILD.

DR. FRANK D. DICKSON, of Kansas City, Mo., said that good health was necessary for the proper development of the individual. The physically unfit child was the backward one mentally. Any factor which limited or prevented the child from engaging in normal activities was a menace to health. A child might conform well to the standards of height and weight and yet fall below normal as regarded health. Dr. Goldthwaite said that to stand erect and move with ease was desirable for very much more important reasons than those purely esthetic, namely, that one might use the body with less expenditure of energy and with greater efficiency. A considerable proportion of the large number of our young men who were found unfit for military service were so because of defects due to bad posture. The correct posture of chest up, abdomen in, and feet straight forward furnished the conditions for the greatest activity with the least expenditure of energy. The opposite posture, sunken chest, protruding abdomen, and flat feet, was conducive to muscle fatigue. A large proportion of children had a sufficiently bad posture to cause symptoms. Dr. Dickson quoted statistics to show that postural defects were sufficiently frequent among children to demand attention.

The present paper was based on 48 cases, ranging from 1½ to 4 years in age. Postural defects were divided into congenital and acquired. The congenital type was that with lax muscles, loose joints, and a tendency to enteroptosis—the long slender type of child, with lordosis and round shoulders. In the acquired type there was an increased accentuation of a tendency to lordosis and prominence of the abdomen, the feet were pronated; in a word, the body was out of balance, and this necessitated a readjustment so that the center of gravity might support the body. Of the 48 cases studied in this series, 12 were the result of congenital malformation; in 21 cases, rickets was present; in 5, the glands of internal secretion seemed to be at fault; in 5, syphilis was the cause of the defect. The muscle fatigue resulting from bad posture expressed itself in such symptoms as leg ache, knee ache, back ache, restlessness, irritability and, in older children, in lack of concentration and failure to get on in school. A con-

siderable number of children having these deformities acquired them as the result of rickets. The long slender type of child with a ptosed stomach which failed to empty itself normally and dragged on the duodenum and gall bladder was liable to suffer from recurrent attacks of gastrointestinal upsets. These attacks frequently occurred about once a month. Talbot and Brown had explained that bad posture might explain cyclic vomiting together with a certain degree of fat intolerance. Functional albuminuria was often seen in these cases. Arthritis was occasionally seen associated with poor posture. Dr. Dickson said he did not claim that all symptoms from which these children suffered were due to bad posture alone, but the presence of one or more of these symptoms suggested that a consideration of the body posture was indicated. The treatment of these children consisted in training in proper postural habits, regulation of the diet, correction of deformities, and exercise, each of which was equally important. In conclusion, it was suggested that bad posture might even furnish the explanation of some acute conditions, hence a careful examination of every child in reference to body mechanics was of importance. In the handling of these cases there should be coöperation between the pediatricist and the orthopedic surgeon. Attention to posture was important because of its effect on the later life of the child.

#### BODY FATIGUE IN THE MALNUTRITION OF CHILDREN.

DR. BORDEN S. VEEDER, of St. Louis, stated that for a number of years he had taken considerable interest in a group of underweight and thin children with no striking pathological condition, most of them coming from homes of good economic circumstances so that lack of proper food seemed not to be the cause of the malnutrition. He felt that in some instances bad posture was the cause of the gastrointestinal disturbances presented. For a time he was inclined to attribute the condition to heredity, characteristic traits, or something of that kind. But he found that this did not seem to furnish the explanation of the condition. He observed 2 or 3 of these cases in the home and it seemed that the basis of the condition lay in fatigue, and treatment based on that theory had given prompt results. If one watched these children it was found that they became tired in their play, and forgot to relax.

The causes of fatigue might be multiple; it might be due to bad posture, to over work or over play or over study. In the complex lives of many modern children, too many parties, too many movies, too much excitement and too little rest and relaxation, might be found the explanation of the condition presented by these children who were simply underweight and under par and in whom there was no definite pathologic condition. The removal of physical defects was not the entire solution of the problem of handling these children; one must study the environment in which the child was living and among other things see that he was getting the amount of sleep he required. Published statements in regard to the amount of sleep needed by the growing child were very indefinite. These had been analyzed and a record of sleep in a group of malnourished children had been made in an attempt to determine the importance of this factor. The amount of sleep required was an individual matter but there was a minimum of sleep which every child must have. Such a minimum he had worked out. It was as follows: A child of 1 to 2 years required 13 hours sleep in 24 hours; one 2 to 4 years of age required 12 hours; from 4 to 6, 11 hours; from 6 to 10, 10 hours, and from 10 to 14, 9 hours. It must be remembered that this was only a minimum to be used as a basis for judging of the amount of sleep necessary for each individual child. In order to ascertain how great a part insufficient sleep played in malnutrition, Dr. Veeder studied a series of 80 children, 15 to 20 per cent. of whom were underweight, checking up the number of hours of sleep they were getting. He found that 40 per cent. of these children fell below the minimum requirement as regards sleep. Then, too, the conditions under which they slept played a part, as whether there were 1 or 2 in a room, whether there were 2 in a bed, the size and ventilation of the room, etc. In closing, Dr. Veeder said that the more he had studied this matter the more he had been impressed with the importance of rest and relaxation in relation to the general health of the child and the problems of malnutrition. Propaganda directing attention to the need of restricting the activities of these malnourished children was needed as much as that setting forth the need of proper clothing, bathing, care of the teeth, and proper diet. Modern life interfered seriously with the growth and development of a great many children.

*Discussion.*—DR. FRITZ B. TALBOT, of Boston, expressed the

opinion that these 2 papers had dealt with 2 very important factors in the well-being of children. The question of fatigue and the question of good posture so interlinked that they formed a vicious circle; fatigue made poor posture and poor posture made fatigue. When poor posture was corrected the fatigue ceased. It was important to remember that fact in connection with mechanical devices used in the correction of improper posture. In the reports he and his associates had made on extreme cases of improper posture with extreme symptoms he thought they had shown how important posture could be in severe cases. Dr. Dickson's paper emphasized the same thing in reference to the milder cases. It was a rather common experience for those who were taking posture into consideration to find that when the posture and fatigue were corrected, lines under the eyes, lack of appetite and constipation disappeared and efficiency increased. Dr. Talbot emphasized the point that in cyclic vomiting one must always bear in mind that he was dealing with a potential appendicitis. One must always remember that the underlying basis of cyclic vomiting might be not posture but chronic appendicitis. That had been the after history of 2 cases that improved when the posture was corrected but did not become entirely well, so one should not be carried away by enthusiasm in the correction of posture defects and forget that there might be a surgical condition back of it. However, the results of correction of postural defects were sometimes brilliant.

DR. C. F. WAHRER, of Fort Madison, Iowa, brought out the point that many of these children had malposition and malnutrition because they were constitutionally inferior. If one looked at the parents of these children he would see that the parents had these same defects and that we had to break in on a vicious circle. The parents must be taught that they must not permit such position in their children. The family physician must draw attention to this matter and the poor school teacher, who had been made responsible for everything, must be asked to help, and a paternalistic government must take a hand. The matter of posture was indeed no small thing. A proper carriage was an important matter in the self-respect of the individual, aside from any question of pulchritude. Perhaps when the family physician brought the matter of posture to the attention of the parent he would be told that it was none of his business but he should not

be disconcerted by that but should be proud to be the instrument in the making of a better, a greater and a prouder mankind.

DR. JOHN A. FOOTE, of Washington, D. C., said that Dr. Dickson had made the statement that deformities or mechanical defects produced malnutrition. He thought it important to mention that malnutrition produced mechanical defects, and while it was proper to say that these conditions were due to muscle strain and maladjustment in the acquired types we did not know as much as we should know. Dr. Schroeder, of New York, who was doing work of this kind for the Association for Improving the Condition of the Poor, had investigated some 2,000 children and his observations according to age grouping were worthy of attention. He found in the children from 2 to 6 years of age, the pre-school group, a very startling number of orthopedic defects. The orthopedic defects ranged between 2 and 3 per cent. in all the children of all ages, while in the children between the ages of 2 and 6 years, 24 per cent. showed orthopedic defects. In the children from 6 to 12 years, there was a drop to less than 8 per cent. Further analyses of the observations made in this series of children showed these defects to be due to deformities of the long bones and deformities of the thorax and bony spine. It would seem that in a study of this kind one could find some of the reasons for muscle fatigue. The deformities of rickets had a tendency to correct themselves as the child grew older. The posture habits were formed in childhood when the child was trying to correct the defects of the long bones and in that way he acquired certain habits of muscle imbalance which persisted after the original orthopedic defects were cured. In the prevention of rickets we had a means for the prevention of orthopedic defects, and this could be done by encouraging maternal feeding and providing a suitable diet for children.

DR. C. H. JOHNSTON, of Grand Rapids, Mich., said the books stated that poverty, malnutrition and tuberculosis went hand in hand, and he did not have statistical data to deny that statement, yet the observation of a large number of malnourished children showed that this condition was more common among the children of the rich than among those of the poor. In a district inhabited by the rich, 40 per cent. of the children were found to be malnourished, while in a poor district only from 20 to 25 per cent. of the children were found to be suffering from malnutrition. Were

we going to find that there was some other factor in the study of tuberculosis besides infection, just as we had found that there was a specific cause for rickets. Next year he would like to have someone read a paper showing the specific part malnutrition played as a cause of tuberculosis.

\* DR. E. J. HUENEKENS, of Minneapolis, Minn., emphasized what had been said in reference to malnutrition as a cause of bad posture and as to the benefit of rest in malnutrition in children. After listening to the paper of Dr. Talbot and Dr. Brown last year, Dr. Huenekens said he spent 2 weeks in Dr. Goldthwaite's clinic and then went home and applied what he had learned in the clinic for pre-school children. The first thing they insisted upon was in getting the child started in the Goldthwaite position and then much could be done by systematic exercise to develop that position. When the physical defects were corrected and a proper diet given, there was still a residue of cases in which there was a faulty home environment so that the child lived in a neurotic atmosphere and treatment had to be directed to the parents.

DR. DICKSON, in closing the discussion, said he did not intend to convey the impression that he thought postural defects explained all things that they found in this series of cases. There were other elements. Of the 48 cases, 21 showed evidence of rickets. For that reason he never consented to handle one of these cases unless he had a pediatricist with him, because it was only by the close coöperation of the pediatricist and the orthopedist that the best results could be obtained. Those in orthopedic work were in a little better position to correct postural defects than the pediatricist and he was sure that when it came to regulating the diet the pediatricist could do better than the orthopedist. He thought that even in charity cases they should get together and train the children and give them a fair start in life.

DR. BORDEN S. VEEDER, of St. Louis, said that they all recognized that malnutrition was a complicated subject. Up until last year in their work all the attention had been directed to diet and the correction of physical defects, such as carious teeth and bad tonsils, but it had been his experience that these things would not cure a large percentage of cases and hence he wished to emphasize the importance of rest.

## HEART DISEASE IN CHILDREN OF SCHOOL AGE.

DR. ROBERT H. HALSEY, of New York, presented this contribution. He stated that just before the war an investigation was started to make a study of heart disease as it occurred in school children in New York City. At this same time the Association for the Prevention and Relief of Heart Disease was organized and classes for cardiac children started. A large number of organizations had had a part in the work in addition to his department at the Post-Graduate Hospital. In order to learn something about the incidence of heart disease among school children they selected 17 public schools from which the children were sent to them. Forty-four thousand children registered with them and of this number there were 946 that they had reason to believe were heart disease. 443 of these were found to come within the groups which had been used to classify the cases attending the cardiac clinic. This classification was as follows: 1. Those having organic heart disease who were able to carry on their habitual physical activities. 2. Those having organic heart disease in whom there was a slight diminution of activity or even a great diminution of activity but who were still able to carry on some activity. 3. Those having organic heart disease and not able to carry on their activities. 4. Cases, possibly heart disease, which were not able to carry on physical activity. 5. Potential heart cases. Of the 946 cases, 228 fell in the first 3 groups. In Group 4 there were 163 cases. Only one-half of one per cent. of the 44,000 cases had actual organic heart disease. Of those having organic trouble, 77 per cent. had mitral lesions and 9 per cent. had aortic disease. The acquired lesions came to somewhere from 87 per cent. to 89 per cent., leaving 14 per cent., which might be considered to be congenital. Group A children were thought not to require any special attention. In a study of 125 cardiac children, the history showed tonsilitis in 65 per cent.; rheumatism in 45 per cent.; measles in 36 per cent.; pneumonia in 18 per cent.; diphtheria in 21 per cent.; chorea in 18 per cent.; pertussis in 17 per cent.; scarlet fever in 12 per cent. Measles in normal children had an incidence of 58 per cent. and whooping cough, of 33 per cent. Tonsilitis, chorea, and rheumatism were more common in cardiac than in normal children, whereas measles and whooping cough were much more frequent in normal than in



cardiac children. The reason for the lower incidence of measles and whooping cough in the cardiac child was believed to be due to the fact that he was not allowed to come in contact with other children to the same extent as did the normal child. The statement was often made that the gathering together of a group of children with heart disease had a depressing and distinctly bad effect on these children. That was not the case with these children, but on the contrary, their outlook on life was better as they felt that they could do something and the fact that their teachers and parents felt that they could do something, surrounded these children with a more cheerful atmosphere. The philosophy of dealing with these children, lay in teaching them to do the things that were within their capacity. The practical classification which had been presented was a valuable aid in differentiating and managing cardiac children by regulated, graduated physical exercise which included improving the carriage and posture of these children. This improvement was evidenced in their general condition, in their alertness, precision and ability to carry-on with less muscular effort. The better school attendance of these same children after supervision, compared with their attendance before coming under their care, bore witness to the value of the methods used.

*Discussion.*—DR. WILLIAM P. ST. LAWRENCE, of New York, said he thought those interested in the cardiac problem had listened to Dr. Halsey's paper with a great deal of interest because he had started upon an experiment which would aid in solving the question of the attendance of the cardiac child at school. The places where the work Dr. Halsey had reported overlapped the work in which he had been interested showed that their results were in harmony at these points. In Dr. Halsey's series of cases, the second group, those who could not carry-on as normal children, included a much larger number than one found in the rank and file of cardiac cases. In his experience, 75 per cent. of cardiac children had exercise tolerance and 25 per cent. had a relative amount of exercise tolerance. There were only a few who had such a diminished exercise tolerance as to be a problem. In only 3 per cent. of the children in their clinic had the exercise tolerance been sufficiently low to be a serious factor. As to the proper care of the cardiac child, attention to the tonsils, a proper amount of sleep, a suitable diet, etc., played an important part.

After these matters were regulated, a great deal of attention need not be directed to the question of exercise. The child as a rule tended to seek his own exercise level. One did not as a rule need to prescribe physical exercise. Adults did not tend to seek exercise and hence one had to prescribe exercise for them, but children were naturally active and took a reasonable amount of exercise. As to the result of therapeutic exercise in adults, he could not speak, but in children he did not see dramatic results.

DR. HAVEN EMERSON, of New York, expressed the belief that from Dr. Halsey's paper and that of Dr. St. Lawrence, it must be apparent that there had been thrown open a large field of preventive medicine. The whole thing was in the hands of the private physician. In dealing with this disability there was an opportunity for the private practitioner to come into his own. The outcome was going to depend upon the keenness of the profession in handling it. We had seen the death rate of tuberculosis drop from 250 to 124 per 100,000 as a result of efforts to control that disease. The mortality from cardiac disease still stood at 200 per 100,000 population. Approximately one per cent. of the population had tuberculosis and there was practically the same incidence of active cardiac disease. In New York City they had 30 clinics for tuberculosis patients and 8 per cent. of sufferers from tuberculosis attended these clinics. We now had an equal number of cardiac clinics and that number was probably sufficient for the community, as there would be need for about as many clinics as were needed in the care and prevention of tuberculosis. In the regulation and control and prevention of tuberculosis and communicable diseases they did not get control of the situation until more cases were reported than actually occurred; it was equally true that we would not reach the true worth of the cardiac clinics until more cases sought treatment in the cardiac clinics than actually had heart disease. This promised to be a step toward the annual overhauling of everyone. These cardiac clinics were developing unconsciously the ability to diagnose heart trouble before the patient knew he had it. If the situation were properly handled the cardiac clinics would have not only the opportunity of finding early cases of tuberculosis, but they would get the cardiac in the incipient stage. The cardiac patient today did not come to a clinic until 4 to 8 years after he had first observed symptoms. It used to be that the tuber-

culosis patient did not come to a clinic until his disease was far advanced. He thought the problem would have to be segregated and that they would have to have not only special preventive and diagnostic clinics but a service to give temporary relief in cases of periodic decompensation.

DR. GEORGE DOW SCOTT, of New York, expressed the view that it was impossible to put down a general statement for the general physician as to the management of cardiac cases. It was not difficult to say which patient should be put to bed and which should not be put to bed, but there was a large group of cases, the so-called functional murmurs, that should be put to bed only as long as was necessary, and should be allowed to be up as soon as possible; others should not be allowed to know of their condition.

In many cases that he had seen he had not told the mothers or the patients that the heart disease was spreading. He had told them to go on with their regular exercise and their natural, normal play. He felt that play was far better than regulated exercise. With normal play and proper nutrition these children with functional murmurs got on well. About 90 per cent. of these children had mitral regurgitation and he only put them to bed long enough to get back on their feet. In his estimation there were many potential heart cases not due to tonsilitis, or to rheumatism or chorea, but due to malnutrition, because an enormous amount of protein formed the basis of their diet. Many of these cases came with meteorism, constipation or not constipation, and with tonsilitis or without tonsilitis, and in many of these the diagnosis of incipient heart disease had been made. Those cases should not be relegated to a place where there were segregated cases. To segregate these cases and center their attention on the cardiac condition was wrong. The heart was a muscle and the more it was developed, under proper regulation, the better and quicker would the individual be able to carry-on. He knew of cases of this kind that had been allowed to carry on normal activities which were better off today than they were 20 years ago.

DR. C. F. WAHRER, of Fort Madison, Iowa, said that sometimes these heart cases were very serious and one felt that they were not very hopeful cases, but they should not be given up. In reality they were very hopeful cases. In decompensation in

children one should support the heart and unload the portal system; the latter was very important. He cited a case of the worst kind of decompensation in which he had followed the plan of treatment he had mentioned. In 3 weeks the child was taking graduated exercise and in 3 months she was able to climb an elevation of 700 feet and to resume her studies. Today she had complete compensation. The main point in handling these cases was never to give up.

DR. HERMAN SCHWARZ, of New York, said it was due Dr. Halsey and his associates to explain just what they, with the aid of the City of New York, were trying to do. There was a surprising difference between the children one saw in private practice and those that came to the dispensaries in New York City. For many years it was a terrible thing to see one cardiac case after another come to the dispensaries and all the doctors could do was to send them home. They were glad everyone was becoming interested in the care of cardiac children. There was no question as to the value of the work. The question was how to do it. They had first tried the convalescent home, but there were too few of these institutions, and now they were trying the cardiac classes in the schools. These cardiac classes, through Dr. Halsey's instigation, had tried to supervise the child during most of the day. They used to be told when the children went home that the mothers did not have time to look after these children so these cardiac classes were formed which took care of the children from 8.00 a. m. to 5 p. m. which was a great step forward in the care of cardiac children among the poor. Branch cardiac hospitals were needed; such hospitals should be connected with general hospitals, where a child with marked decompensation might be put to bed under good medical care and remain months, or even years, if necessary. He could when ready be graduated into the cardiac schools and graduated into adult life and do good work. Dr. Schwarz said he was dreaming of such a plan. The discovery of the etiological factor in rheumatism would obviate a great deal of the difficulty surrounding the solution of the problem of cardiac disease in children.

DR. HALSEY, in closing the discussion, emphasized the advantages of the classification of heart disease which he had presented. With reference to the question which Dr. Scott had

raised, he expressed the opinion that it was all wrong to say that the cardiac should not know of his condition. That was one of the very important advances that had been made in the treatment of heart disease. If one was going to get the coöperation of the people among whom the cardiac child lived he must tell them what the children had and what could be done for the condition. They must be told that a great deal could be done for these children and how far they could go as regards exercise and when they must stop. That was what was being done by the clinics. What could be the objection to the segregation of these children, to send them to a man specially interested in cardiac disease who had a special knowledge which was entirely technical and diagnostic. They used the fluoroscope and the electrocardiograph for what information they could give, though these instruments did not make the diagnosis of heart disease. As to the question of food for the cardiac child, the cardiac child needed food so far as he could take care of it. One should not get the idea that one protein was as good as another. All meat should not be excluded from the diet. Some had spoken of the Class 3 children, or those with heart failure. He had not gone into that group because he was speaking more particularly of the children in the schools. One more question was brought up and that was what they were trying to do in New York. They were trying to find some solution of the problem, and this was only preliminary work. They had tried this plan with a group of 44,000 out of the 800,000 children in the public schools. As in any work of this kind the assistance of well educated, tactful social workers was essential. A social worker could take care of about 100 children and no more. Beyond that she could not find time to look after the individual child. The child's temperature and pulse were taken every day. Not in order to know exactly what the temperature was, but to know whether the child was running a temperature as a regular thing. The social worker did many things beside taking the temperatures. She gained the confidence of the child and that of the mother so that instructions would be carried out and she be in a position to get the mother's coöperation if a tonsillectomy were necessary or for whatever they believed should be done. This propaganda was in its infancy and it was essential that they should have a proper boost.

## THE TREATMENT OF FURUNCULOSIS IN INFANTS.

DR. CLIFFORD G. GRULEE and MISS CASSIE BELLE ROSE, of Chicago, presented this paper in which the relative merits of the treatment of furunculosis by means of antiseptic ointments and liquid antiseptics were discussed, and their inadequacy pointed out. They had tried a combination of the treatment by antiseptic solutions and the x-ray. Dr. Pancoast recommended the application of erythema doses of x-ray in 2 to 4 sittings, over a period of 2 weeks. They had not attempted the treatment of furunculosis in babies. The difficulties of treating infants with the x-ray and their susceptibility to the x-ray were well known. In one instance, some of the furuncles were treated while others were left untreated. The individual furuncles treated subsided, but the x-ray did not prevent other furuncles from appearing. In a general way their impression of the x-ray treatment of furunculosis was favorable, though the series was too small to warrant a statement as to the ultimate results as compared with other methods of treatment. It was better to use the soft ray and no filter. Certain reactions had occurred so regularly following the use of the x-ray in furunculosis that they suggested that others employ it in order that a just estimate of the value of this form of treatment might be reached. It had not done away with the necessity for surgical procedures, but it had reduced the necessity for opening furuncles where they were superficial. They felt that there was ground for the hope that the x-ray might add materially to their means of treating furunculosis.

*Discussion.*—DR. MYER SOLIS-COHEN, of Philadelphia, stated that the results of the vaccine treatment of furunculosis had been rather unsatisfactory, but they could see the explanation in some work done recently. The blood of animals immune to a disease killed the organisms that caused that disease, while the blood of animals susceptible to the disease did not kill these organisms. For instance, if the fresh blood of a chicken killed the pneumococcus that chicken was immune to that type of pneumonia. Kolmer had found the same thing true of the meningococcus. Another investigator had found that the blood of rats immune to diphtheria killed the diphtheria bacilli while the blood of rats not immune to diphtheria did not kill the diphtheria organisms. Dr. Heist and the writer had applied this method to various infections and

they had found that it was true of furunculosis. Dr. Solis-Cohen then described a method they had used in preparing a convalescent serum for use in furunculosis, and also a method of making vaccines. They had found that furunculosis should respond to this method of treatment.

DR. GRULEE, in closing the discussion, said in reply to the question as to whether he had used the x-ray in pemphigus in the new born, that he had not had the temerity to try the x-ray in the new born because the skin of a new born infant was too tender to run that risk. As to the vaccines, it was quite a while since he had abandoned their use as he had never gotten any good results. Where the results appeared to be good he thought it was merely a happening. He had had no experience with the methods Dr. Solis-Cohen had described.

#### THE BENEFICIAL EFFECTS OF TONSILLECTOMY UPON CYCLIC VOMITING AND ALLIED AFFECTIONS.

DR. ALBERT H. BYFIELD, of Iowa City, gave a brief review of the important aspects of cyclic vomiting. Among the points that had impressed him were the fact that in the large percentage of cases cyclic vomiting began in the second year; another point was the high percentage of true migraine in the parents of children suffering from cyclic vomiting. In his series of 27 cases, 16 were blondes and 4 were brunettes, while in 7 no observation was made on this point. This raised the question whether the preponderance of blondes was more than a coincidence. Pyuria was present in many of the cases during and between the attacks. The most prominent symptoms were nausea, vomiting, abdominal pain, and light colored stools. Some cases were atypical and were called simple bilious attacks. Cyclic vomiting seemed to be a neuro-pathic content. The child who suffered from cyclic vomiting was born of a strain that was impaired, as evidenced by the frequent history of migraine in the parents. The preponderance of blondes suggested the possibility that the exudative constitution might play a part if one admitted, as some claimed, that blondes were more likely to have the exudative constitution than were brunettes. It was also pointed out that the arthritic diathesis might have a relation to cyclic vomiting and some had held that the

exudative and the arthritic diathesis were perhaps identical. The production of acetonuria by starvation did not always bring on an attack and it was a question whether acetonuria played a prominent etiological part. Attempts to control the disease had not always given the results desired. There was a suspicion that the Jersey cow was a common source of trouble. The calf of the Jersey cow frequently could not take its mother's milk and only a human being would be so presumptuous as to give it to a child. In a few cases removal of the appendix had brought about relief and cure. Dr. Sedgwick and Dr. Rude Taylor had called attention to the tonsils as a source of infection that was responsible for recurrent attacks of vomiting. Of the 27 cases in this series, 20, in which dietetic measures had failed, were operated upon for removal of their tonsils and adenoids. Of these, 10 had no further attacks; four had three attacks and then none. This 14 or 47 per cent. were cured by tonsillectomy if one could rely upon the statements of the parents. Four were improved, and of these, 2 had sinus and nasal infection. Two of the 20 reported no improvement. Of the 7 cases not operated upon, only one was cured; the parents of 4 of the children were positive that the child was not improved. In one instance, in which removal of the appendix had failed to give relief, removal of the tonsils and adenoids caused a prompt disappearance of the vomiting. Dr. Byfield called attention to a tendency to regard recurrent vomiting as an acidosis. Acidosis was a complication and not a cause of the condition, and acetonuria, it was to be remembered, occurred in many other conditions. The main points in the medical treatment of these cases was the avoidance of the indulgence in excessive amounts of fat; undue nervous strain should also be avoided. Where medical treatment failed to give relief, conservative surgery was justifiable. Incomplete removal of the tonsils might fail to give relief, hence a tonsillectomy should be thorough and complete.

*Discussion.*—DR. JOHN ZAHORSKY, of St. Louis, stated that this class of vomiting cases was often dependent upon some infection of the tonsils, and when that was the case the children were benefited or cured by operation. By watching these cases and seeing them repeatedly, one often came to the conclusion that there was an infected focus. However, cases due to infection of



the tonsils, adenoids and nasal sinuses should be differentiated from those of neurotic cyclic vomiting. He had had 2 cases in which the attacks of cyclic vomiting came on after complete operations by the best operators in children of the neurotic type. In cases of cyclic vomiting one should always have corroborative evidence of local infection in the tonsils and adenoids before subjecting the children to operation.

DR. F. P. GENGENBACH, of Denver, Col., stated that it was easy to differentiate these cases. By examining the tonsils one would usually find that the vomiting was associated with tonsillitis in cases in which the tonsils were infected. There was no question that local infection was harmful to the individual and if the infected tonsils were removed the child would be improved, and if he believed the tonsils should come out he should insist upon tonsillectomy. But one must have the courage of his convictions, one should not omit the examination of the tonsils when treating a case of cyclic vomiting. If the tonsils were found infected, the physician should insist upon their removal. He had seen cases in which the physician had failed to look for trouble in the tonsils.

## THE PHYSIOLOGY OF THE BLOOD IN INFANCY AND CHILDHOOD.

DR. WILLIAM PALMER LUCAS, of San Francisco, gave some of the results of a comprehensive morphological study of the blood cells and hemoglobin in the new born, and emphasized the point that the study of the blood as a tissue gave much information as to what was going on in the body. What was just as important, if not more so, was that such a study gave a fair idea of what was going on in other tissues and organs. Directly, it furnished a conception of the existing state in the blood-forming tissues, as the bone marrow. An analysis of the various factors of the blood supplied a means of studying directly the functioning power and the potential capacity under strain of different organs, as the kidneys, liver, lungs, and to a certain extent of the conditions existing in the tissue cells throughout the body at the time of the study.

## SYMPOSIUM ON COMMUNICABLE DISEASES.

## DIAGNOSIS AND TRANSMISSION OF INFECTIOUS DISEASES.

DR. DENNETT L. RICHARDSON, of Providence, R. I., declared that very few physicians realized the extent of infectious diseases and the prominent part they played as a cause of sickness and death and particularly the place they held in the mortality tables in the United States. In the registration area of the United States in 1918, of 1,471,367 deaths 490,275 were due to infectious diseases; in other words, infectious diseases caused one-third of all deaths in the United States in that year. However, 1918 was the influenza year. The average number of deaths due to infectious diseases had been calculated at about 244,681. The actual number was in reality much larger. Eighty or ninety per cent. of these deaths occurred in children under 12 years of age. It was important that all physicians, and particularly pediatricists, should be taught to diagnose infectious diseases and to know how these were transmitted from person to person. Few medical schools put the teaching of infectious diseases in the hands of those who were experienced in the treatment of such conditions, namely, physicians in charge of contagious hospitals. Students graduated with the idea that scarlet fever always presented a definite clinical syndrome, whereas there was a considerable percentage that did not conform to the classical picture. The schools could easily teach the cause of each disease, by what routes it escaped from the body, how soon the patient became infected, for how long it continued to be infectious and what diseases developed the carrier condition. The diagnosis, however, could only be taught in a contagious hospital. This was a training which no pediatricist could afford to omit, since these diseases were chiefly seen in childhood. It was quite possible to obtain this training without contracting contagious disease. The new hospital for contagious diseases would care for erysipelas, typhoid fever, meningitis, poliomyelitis, syphilis, gonorrhea and other infectious diseases as well as those it now cared for. Infectious diseases did not belong in a hospital where other diseases were cared for. The acute infectious disease hospital might be located on the grounds with a general hospital, but it should be manned by physicians and nurses who knew how to treat and nurse infectious

diseases. Had we had properly trained physicians and nurses to care for infectious diseases we would not have had to pass through such an experience as we had during the World War when there were so many cases of infectious disease and so few physicians and nurses trained to care for this class of diseases. All children's hospitals should be conducted along the lines of contagious disease hospitals. An aseptic nursing technique should be carried out in contagious disease hospitals since it had been fairly well demonstrated that diseases were rarely air borne. By the use of aseptic technique cross infections in the Providence Municipal Hospital had been reduced for a time to as low as 1 per cent. More than one-half of cross infections were due to measles and chickenpox.

Our knowledge of infectious diseases, the writer said, was very limited. Of this the average practitioner was not aware. Our textbooks on contagious diseases were very faulty. We had not made the progress in the knowledge of these diseases that should have been made. Scarlet fever was as prevalent as ever and diphtheria was more common than it should be. The statement that 90 per cent. of all scarlet fever cases were cared for in hospitals was not true.

*Discussion.*—DR. EDWIN H. PLACE, of Boston, said that so far as the hospital went he thought a great deal of misunderstanding occurred among laymen and even among physicians as to the methods of isolation of contagious disease which had always been used. The Boston Hospital which was started in 1891 and occupied in 1895, had certain elements in its arrangement that indicated that people believed that disease was air borne. Many did not believe in the cubicle system as they did not see how contagion could be prevented when there was open air space above the cubicles. It was rather strange that while people had recognized the need for isolation and had provided adequate screening, they had made no provision for guarding against infection from linen or hands. The doctors had had to wash their hands with a bowl and pitcher in the contagious hospital in 1900 and subsequently. This was an illustration of how slow hospitals had been to carry out in practice well known facts with reference to the prevention of contact infection. He disagreed with the statement as to the difference in the spread of measles and chickenpox as compared with diphtheria and scarlet fever. He

did not think the spread of measles and chickenpox was any different from that of scarlet fever and diphtheria. There was a difference in the susceptibility of the individual; that was the only difference. He knew of one instance in which measles and scarlet fever were in the same ward service and had the same kitchen and nursing service. There was no instance of measles being carried into the scarlet fever ward, but there were many instances of scarlet fever being carried into the measles ward. Measles required much more direct contact than scarlet fever, but scarlet fever might be carried on the clothing.

DR. HENRY W. BERG, of New York, said he was connected with a large contagious disease hospital and unfortunately polyinfections occurred quite frequently though he did not know that they occurred more frequently now than they formerly did. If any doctor could tell us how to prevent polyinfections he would do an inestimable service to humanity. There were many infections not transmitted. Typhoid fever and diphtheria were not transmitted and the reason was because we knew the organism. We knew how it entered the body and how it was extruded. The trouble with measles and scarlet fever was that we did not know the organism. He feared that we should never be able to prevent polyinfections until we knew the causative organisms of these diseases, their life history, clinical characteristics, transmissibility, the way they acted, and the way they were extruded from the body. He knew of no greater misfortune than that a child should be admitted to a hospital for measles and then should have scarlet fever, diphtheria and other infections. The man who could designate, not in general terms but specifically, how these polyinfections could be prevented, would be one of the greatest benefactors of humanity.

DR. C. F. WAHRER, of Fort Madison, Iowa, related an instance in which a doctor treated several children in a family for scarlet fever and then 3 weeks later confined the mother. She became infected and 3 laparotomies were necessary. She was living but had passed through death to live. A doctor who was treating a scarlet fever case should know enough to keep his hands off other cases.

DR. A. W. PLUMMER, of Lisbon Falls, Maine, said he would be glad if the author of the paper would vouchsafe some information with reference to the diagnosis of scarlet fever as to a point

he wished to raise. He had had 2 cases of scarlet fever in which so far as he could see the only symptoms of scarlet fever were an elevation of temperature, rapid pulse, vomiting, and sore throat and in one a strawberry tongue. In one of these cases he had had a consultation and the diagnosis of scarlet fever was confirmed. In neither case were there any signs of desquamation. The question he raised was whether his diagnosis of scarlet fever was correct and whether others had seen similar cases.

DR. RICHARDSON, in closing the discussion, said he did not want to give the idea that chickenpox was carried by the air. It was a long story but it would be found out sooner or later that these were surely contact diseases. Relative to the last speaker's question about scarlet fever, it did not matter how many contagious diseases a man had seen, he could not diagnose them all. There was a considerable percentage missed because we had no means of recognizing them. Probably not more than 30 per cent. of scarlet fever cases had strawberry tongue. Many times he had seen a sore throat in a child in a family in which there had been a case of definite scarlet fever and in such a case one was justified in making a diagnosis of scarlet fever on the ground of exposure whether the child had a rash and strawberry tongue or not. There were many more cases of diphtheria that did not show a membrane than of those that had a membrane. With known contact he had the suspicion that measles might occur without any rash whatever.

#### CERTAIN ASPECTS OF POSTDIPHTHERITIC DIAPHRAGMATIC PARALYSIS.

DR. HAROLD RUCKMAN MIXSELL and DR. EMANUEL GIDDINGS, of New York, presented this paper in which they gave a resumé of the subject and discussed the anatomy and pathology of phrenic nerve involvement by the diphtheria toxin and toxon. The frequency of diphtheritic paralysis was higher than one would suppose, being 8 per cent. of all cases of paralysis and 0.2 per cent. of 4,259 cases of diphtheria. The average date of onset of the paralysis was 39.5 days after the onset of the disease. Death usually occurred within 48 hours. The symptoms were those of respiratory failure. There was no active treatment by means of drugs when the damage was done by the diphtheria toxin. Marriott had reported an instance in which artificial respiration had

resulted in tiding the child over the acute stage of respiratory failure. The child ultimately recovered. The writer reported 8 cases, and stated that the prognosis was 100 per cent. fatal. In view of this fact, treatment by means of intratracheal insufflation, the pulmotor and the Erlanger-Gessel apparatus was worthy of trial.

*Discussion.*—DR. ROBERT J. WILSON, of New York, said he was glad to have a paper of this kind emanate from the Willard Parker Hospital because it showed that the hospital was taking its place as a teaching institution. They were all familiar with the unreliability of statistics. These statistics were reliable but they came from an institution notable because it received so many cases in a hopeless condition. So, in a way, it might be taken that the proportion of cases of diphtheritic paralysis was far too low; that was that where more cases survived until the later stage of the disease there paralysis would occur more frequently. A second point Dr. Wilson made was that if the doctors in New York City had been doing their duty since the discovery of antitoxin there would not have been a chance to report these cases. All this was preventable. It was the duty of the American Medical Association to see that the people themselves and the mothers were educated as far as possibly could be done to a sufficient degree to know when to call a doctor and that the doctor be sufficiently intelligent to know when to give antitoxin and to know that he should not wait for a Schick test or a culture.

DR. HENRY W. BERG, of New York, thanked Dr. Mixsell for this extremely interesting series of cases. He said these cases were important because they were fatal and furthermore because every bilateral phrenic nerve paralysis was fatal. It occasionally happened if one could make the diagnosis when the paralysis had affected only one side that one might get a case early enough to have one side getting well before the paralysis on the other side developed. Many unilateral cases occurred, and were not recognized because the rest of the diaphragm on the other side was doing the work. How should one recognize unilateral and bilateral forms of paralysis. Litten's phenomenon on the affected side was absent, there was no abdominal respiration on the paralyzed side and the x-ray pictures showed an immobile diaphragm on one or both sides. The hypoglossal and glossopharyngeal muscles supplied by these 2 nerves became involved and there was

an inability to swallow with the result that the secretions fell back into the bronchi and the patient, being unable to cough, drowned in his own secretions, after having developed a bronchopneumonia. As to therapy, a great deal had been said about artificial respiration by various methods. There was absolutely nothing to be expected from these procedures. Such a patient died because he could not contract his diaphragm and this caused a peculiar paralytic cough. Treatment had to be directed to the side of the paralysis. If but one side was paralyzed, one should use strychnine on the paralyzed side at the site of the sixth intercostal space. This stimulated the long respiratory nerve of Bell to bring aid to the embarrassed respiration. These cases of unilateral paralysis recovered if one got them in time and they were kept alive long enough by stimulating the respiratory centers. It was important to keep the bowel empty as a distended bowel elevated the diaphragm, contracted the lung and made complete respiration impossible.

DR. BORDEN S. VEEDER, of St. Louis, Mo., said there was one point in which he agreed with the previous speaker and that was that these cases occurred much more often than was recognized. Some degree of phrenic nerve paralysis was often overlooked. He disagreed with the statement that these cases were hopelessly fatal. He had seen the case referred to in the paper, which was treated by the Erlanger apparatus. He had seen 2 other cases of postdiphtheritic involvement of the phrenic nerve and both cases recovered so he thought the prognosis was not absolutely hopeless.

DR. EDWIN H. PLACE, of Boston, said one of the speakers had referred to paralysis of the pharyngeal muscles and that the secretions caused hypostatic pneumonia. In private cases and in a large number of hospital cases, the effort was made to turn the patient from side to side and the foot of the bed was elevated so that the secretions flowed out of the corner of the mouth. If the diaphragm was in a bad position it embarrassed the respiratory muscles, so an effort should be made to keep the diaphragm at its lowest point. To do this it was important to avoid distention of the bowels.

DR. H. J. FABER, of San Francisco, said that the New York men had outlined a treatment for postdiphtheritic diaphragmatic paralysis which was very agreeable to listen to. He cited a case

of a child  $9\frac{1}{2}$  years of age with a mild diphtheria who was injected on the third day with antitoxin. When, in the course of his duties as health commissioner, he called upon the child he found him up and playing on the third day after the injection of the antitoxin. The mother said the doctor had not forbidden him being up. He told the mother that if he were the family physician his advice would be to keep the child quiet and on a light diet. When he called at the house 2 days later there was crepe on the door; the child had fallen over dead. Drugs were of little benefit in postdiphtheritic conditions, but rest in bed in a dark room and light diet were very important.

DR. E. C. FLEISCHNER, of San Francisco, called attention to several simple procedures that might aid one in making an early diagnosis of postdiphtheritic paralysis. These were daily observation with reference to the knee jerks and other reflexes, particularly the palatal reflex. Postdiphtheritic nerve involvement might be avoided if proper attention were given to rest over a sufficiently long time.

DR. A. F. M. GREENE, of Fergus Falls, Minn., asked for information with reference to the case of 2 boys who had an attack of mild pharyngitis and later involvement of the nasal mucous membrane. Five weeks later they began to suffer from difficult swallowing and regurgitation and then entire paralysis of speech and involvement of the limbs. They became helpless. One of the boys died and the other recovered. At the time they had the sore throats they were given only palliative treatment but had no antitoxin. The physician who attended them claimed they had had a streptococcus infection. The surviving boy was extremely nervous and irritable. Dr. Greene asked what the prognosis was with reference to the nervous symptoms and what the opinion was as to the diagnosis in these cases.

DR. MIXSELL, in closing the discussion, said there was not much he wished to add to the paper, but he might lay emphasis on some of the points brought out by those who had taken part in the discussion. The importance of the early administration of antitoxin should be emphasized. In certain parts of New York City, clinicians held that all cases of tonsillitis, whether they looked like diphtheria or not, if there was any doubt as to the diagnosis, should be given antitoxin. This he concurred in heartily and he had followed out this procedure for the past 8 years. Dr. Berg



had brought up the question of the injection of strychnine. Personally, Dr. Mixsell said he had failed to see much benefit from the injection of strychnine into the diaphragm or elsewhere. He might be wrong, however, and it should be tried out thoroughly. He agreed with Dr. Veeder that the various forms of artificial respiration should be employed. If 2 or 3 cases had recovered, so far as we now knew that was the only way of bringing them through. He agreed also with what had been said about rest. In the Willard Parker Hospital they would like to keep these children in bed 5 or 6 weeks after the late administration of antitoxin, and they were planning to do it. Dr. Fleischner's suggestions were very important. They made it a point to make a daily examination on those points in almost all their cases, especially those who had received antitoxin at a late day. Dr. Greene's cases might be post-diphtheritic diaphragmatic paralysis or they might be something else, probably lethargic encephalitis, but the doctor should have gone ahead with the antitoxin whether the cultures were positive or not. One should not rely upon one negative culture but should send cultures to several laboratories, if necessary, before deciding that the culture was negative.

#### STUDIES ON DIPHTHERIA.

Dr. JOHN HOWLAND, of Baltimore, said that the course of diphtheria was very deceptive. The patient might recover from the first alarming symptoms after the administration of antitoxin only to fall a victim to some complication later on. There might be cardiac and circulatory complications in the second and third week after the onset of the disease, and there might also be complications involving the nervous system, particularly those characterized by peripheral neuritis, perhaps in the seventh or eighth week. Dr. Mixsell had just shown that post-diphtheritic diaphragmatic paralysis occurred about the 35th to the 37th day. It had been conclusively demonstrated that the toxin of diphtheria had an extraordinary affinity for tissue cells and became so closely bound to the cells that it could be dislodged with the greatest difficulty, and after a time not at all. If 2 fatal doses of toxin were administered to an animal, the animal could be saved by different amounts of antitoxin depending upon the time of their administration. If the antitoxin were given within the first

minute, 0.1 of a unit would save the animal; at the end of an hour, it would take 30,000 units, and at the end of 70 minutes, the animal could not be saved at all. Treatment was effective not because it neutralized the toxin that had been absorbed but because it neutralized it before it found its way into the circulation. That was why the prognosis of diphtheria depended not so much upon the extent of the membrane as upon the length of time it had existed. Clinically it was a striking and shocking experience to see a child with a severe form of diphtheria rapidly improve after the administration of antitoxin and become afebrile, and then within 24 to 48 hours, suffer a change, show great pallor, aversion to food, a rapid heart rate, abdominal pain and albumin in the urine. Many of these children died and if they did not die convalescence was slow and there was considerable loss of weight. He had long been interested in finding an explanation of this process. He had made studies on the urine many years ago in the Willard Parker Hospital which were never published. He had long wished to study the total nitrogenous output in patients in nitrogenous equilibrium. But these patients did not take enough food to sustain a nitrogenous equilibrium. Therefore dogs were used. There was a preliminary period during which the dogs were kept in nitrogenous equilibrium. Measured doses of diphtheria toxin were then administered. During the first 2 days following the administration of the toxin there was fever and an increase nitrogen and creatinine output, but it did not show a significant rise. Following this, for 2 or 3 days, the animal seemed perfectly well. Then on the sixth or seventh day there appeared a second period of reaction. During this time the temperature of the animal increased and the total nitrogen showed a marked negative balance. In the majority of the animals the loss of nitrogen was very striking. The same was true of the creatinine though it did not run parallel with the total nitrogen. The excretion of nitrogen was something like 50 per cent. above normal. The weight continued practically the same during the first and second febrile periods and then began to fall very sharply. This sudden excretion of nitrogen could not be regarded as the result of a damming back of the nitrogenous products and then a sudden excretion. It could only be explained as being due to destruction of the body cells. The question then came up whether the destruction of body cells was due to infection

or to fever. Experimental evidence had been obtained to show that these changes in nitrogenous excretion occurred when toxin was injected into the myocardium. Experimental evidence also went to show that the increased nitrogen excretion was due to the infection and not to the fever.

*Discussion.*—DR. DENNETT L. RICHARDSON, of Providence, R. I., stated that clinical observations corresponded with this experimental work. In his experience diphtheria patients frequently died in the second stage; the membrane might disappear, the fever subside and the child look quite well; then during the second week, there would be pallor, prostration, change in the pulse, and the child would die. It had been his experience that children with these symptoms, if they lived 14 to 16 days, might survive.

#### EXPERIMENTAL MEASLES.

DR. FRANCIS G. BLAKE, of New York, stated that they had started this work with the hope of ultimately developing a method of prophylactic inoculation against measles. Monkeys inoculated intratracheally with nasopharyngeal washings from early cases of measles reacted after an incubation period of from 7 to 10 days with a group of symptoms closely resembling measles in man. These symptoms were conjunctivitis, Koplik spots, exanthem, fever and leucopenia. The experimental disease had been transmitted from monkey to monkey by blood, skin, and mucous membrane emulsions, nasopharyngeal secretions and by contact infection. Monkeys that had recovered were immune to a second inoculation. The histologic lesions of the skin and buccal mucosa were identical with those of human measles. The virus could be attenuated by repeated blood passage or by preservation in glycerol so that it would produce a local and not a general infection in monkeys in intratracheal injection, which would, it was believed, protect against measles for a time. (See also ARCHIVES OF PEDIATRICS, Feb. 1921; p. 90.)

*Discussion.*—DR. JOHN F. ANDERSON, of New Brunswick, N. J., stated that it was just 9 years since he and Dr. Goldberger had presented their work on experimental measles. A critical reading of Dr. Blake's paper would show that their work had been repeated and confirmed by Dr. Blake and his colleagues. However, there were some phases of the subject not reported upon by Dr.

Blake as, for instance, the period of infectiousness of the secretions of the nose and throat. As a result of Dr. Goldberger's experiments, the period of quarantine for measles had been revised practically everywhere throughout the world. They had also reported that the virus could be attenuated by repeated blood passages. It had been said that their evidence of having produced measles experimentally in monkeys was not conclusive because they had not mentioned the Koplik spots. It was true they had not mentioned the Koplik spots; they had based their opinion on the skin lesions and the leucopenia. The histology of the Koplik spots was not worked up so well at that time as it was today.

DR. CHARLES HERRMAN, of New York, said that although Anderson and Goldberger, Hektoen and others had already proved that the nasopharyngeal discharges and the blood of patients with measles were infectious, Dr. Blake's investigations have added some new evidence and have put the subject on a still firmer basis. Many years ago he became convinced that with our present methods the spread of measles could not be controlled, and that such a control was only possible by means of a method of immunization against the disease, applied in early infancy. In 1913 he began to immunize infants, the method being based on the following facts: First, the infectious material is contained in an active form in the nasal mucus at the beginning of the stage of invasion, that is just before and when the eruption is beginning to appear. Second, in large cities where practically all mothers have had measles, a relative immunity is conferred on the offspring which lasts about 5 months. This immunity is absolute during the first 2 months and gradually disappears. Third, the infectious material is usually conveyed from the nasal mucous membrane of the patient to the nasal mucous membrane of the individual infected. It was thought that if infants were inoculated between 4 and 5 months of age, when they still enjoyed a relative immunity, this temporary relative immunity could be converted into an immunity which would last for at least a few years. This would be a distinct advantage, for almost all deaths from measles occur in children under 5 years of age, principally in the second year from a complicating bronchopneumonia. With these facts in mind, the nasal mucus from children with measles, who were free from other disease, at the beginning of the appearance of the eruption, was collected on small swabs, or drawn into

capillary tubes which were sealed. This mucus was applied by touching the mucous membrane of healthy infants between 4 and 5 months of age. Up to date 150 inoculations have been made. Of these, 25 infants are definitely known to have been intimately exposed to infection, and of these only 2 contracted the disease. When we remember that about 97 per cent. of all infants over 5 months of age are susceptible to infection with measles, he believed the results are pretty conclusive. It may be objected to on the ground that the material used was not free from other bacteria. In practice this was not found important, as no unfavorable effect was noted in any case. The nasal mucous membrane normally harbors a large number of microorganisms. The filtrate might be used, but it is not uniformly active, and could not therefore be relied on for purposes of immunization. For universal application it is necessary that we should have a method of preserving the virus. The addition of glycerol might answer the purpose, remembering, as Dr. Blake has shown, that by such an addition the virus becomes somewhat attenuated.

DR. HENRY F. HELMHOLZ, of Rochester, Minn., said he was particularly interested in the latter part of Dr. Blake's paper dealing with the production of active immunity and in that connection he would like to call attention to some experiments from the Pfaundler Clinic in Munich with regard to passive immunity on animals. At the Pfaundler Clinic they had shown that 173 individuals exposed to measles and injected with 5 c.c. of blood serum taken from convalescent measles patients, 7 to 14 days after the temperature had dropped to normal, had been absolutely protected against measles. Helmholtz reported that in 10 cases in which the child was in a home with an infected individual, this method of immunization had been tried with apparent success. This was very important because it made available a method of protecting children during the period from 2 to 4 years, when the mortality from measles was so extremely high.

DR. DENNETT L. RICHARDSON, of Providence, R. I., said they had been making similar inoculations with the serum of convalescent patients and no child inoculated in this way had developed measles. They hoped to publish this work a little later.

DR. BLAKE, in closing the discussion, stated that they had been making detailed studies as to the infectivity of the measles virus. They had never failed to transmit the disease to monkeys when

the secretion was taken in the prodromal stage; the secretion taken on the first day always produced measles, and in many instances when taken on the second day. The infectivity was shown to be present in the plasma and not in the blood cell. The reason they had gone into the work of investigating the susceptibility of the monkey to measles was not because they doubted the work of Anderson and Goldberger but because they felt that a demonstration of the pathology was necessary, since the pathology of measles was not so carefully worked up when Anderson and Goldberger did their work.

#### PREVENTIVE DIPHTHERIA WORK IN THE PUBLIC SCHOOLS OF NEW YORK.

DR. ABRAHAM ZINGHER, of New York, reported that since February, 1921, more than 50,000 school children had been Schick tested in New York City. Children found susceptible had been immunized with toxin-antitoxin. Results showed great variability in different groups of school children. In schools attended by the children of the more well-to-do, a much higher proportion of susceptible children had been found than in schools attended by children of the poorer classes. This striking difference could be noted from the results in two different schools; 58.8 per cent. positives in one as compared with 15 per cent. positives in another, a ratio of 3.5 to 1. Relative segregation of children from wealthy homes on the one hand, excessive crowding and frequent exposure to diphtheria in the poorer homes on the other hand, explained the results. Heredity seemed to be an important factor. The control test with heated toxin had been found essential in clearly identifying the pseudo-reactions which were relatively frequent in children of school age. (See also ARCHIVES OF PEDIATRICS, June, 1921, p. 336.)

*Discussion.*—DR. CHARLES HERRMAN said he should like to congratulate Dr. Zingher on what he has accomplished in a comparatively short time. Owing to his repeated demonstrations before the larger medical societies, the majority of the physicians in New York City are familiar with the value of the use of the toxin-antitoxin mixture in the immunization against diphtheria. He has demonstrated statistically that the children in crowded districts are less susceptible because they have been immunized by exposure. This principal has long been recognized in other

diseases, for example in the marked susceptibility of the Indian and Esquimau to tuberculous infection, when he migrates to large centers of population, in the rapid and progressive course of tuberculosis in infants, and in the susceptibility of the recruits from rural districts to the communicable diseases of childhood. It is therefore not an unmixed blessing to protect the child against all exposure to infection. What we desire is immunity against disease, for the prevention of exposure to infection is impossible in large cities. In the control of the spread of the highly communicable diseases, and those in which carriers play an important part, *early* and *universal* immunization are essential. The control of smallpox is due to the fact that practically *all infants* have been vaccinated. The campaign has been begun with the immunization of school children because that was an easy and controllable point of attack. After physicians and laymen are convinced of its value, there will be less difficulty in immunizing all infants. Education is required. In my private practice only 10 per cent. of the mothers immediately recognized its value and were glad to have their babies immunized. An additional 10 per cent. consented after a little explanation and persuasion, but there remained a large number who preferred to wait. Some told me frankly that they did not believe in vaccination, but they had it done because the child could not be admitted to school without a vaccination certificate. There are still a large number of believers in the various cults, who are antivaccinationists, antivivisectionists and antiimmunizationists. Possibly some day a certificate of immunization against diphtheria will be necessary for admission into school, so that all the conscientious objectors will also be brought into the fold.

DR. EVERETT W. GOULD, of New York, said that they had been relying upon the Schick test in all cases entering St. Luke's Hospital, both surgical and orthopedic, as well as medical. All those giving a negative Schick test were not immunized while those giving a positive test were thoroughly immunized. Since this procedure had been adopted 7 years ago, they had not had more than 4 cases of diphtheria in children developing among those who had previously shown a negative reaction. Those cases were all given antitoxin and recovered. It was impossible to say whether these were true cases of diphtheria developing in children previously showing a negative Schick reaction or were diphtheria

carriers who had developed tonsilitis, or, more likely, were instances where the Schick reaction had been falsely reported as negative, as a result of mistake in technique, or in the interpretation of the reaction. From their experience they could say that the Schick test was a most dependable method of determining susceptibility to diphtheria, and cases reported in which it apparently failed were probably instances in which errors had been made either in the technique or its interpretation. In severe cases of tonsilitis that resembled diphtheria, it was always advisable to give antitoxin, not because one did not have faith in the Schick test, but because a slip might have been made in the technique or the reading of the reaction. (See also *ARCHIVES OF PEDIATRICS*, June, 1921, p. 337.)

DR. JOHN M. DODSON, of Chicago, observed that there was one thing that stood out conspicuously and that was the rapidity with which the efficiency of antitoxin diminished as the days went by following the onset of diphtheria, thus showing the importance of getting the cases on the first day. Parents should be educated and the movement for a closer coöperation between educators and the medical profession should be furthered. Forty-two states now had combined committees composed of members of the state medical societies and members of teachers' associations. They offered an army of 500 physicians and teachers who might be utilized to spread the propaganda of early diagnosis and early treatment in diphtheria.

DR. EDWARD L. BAUER, of the Philadelphia Health Department, said Dr. Zingher's figures made a formidable array which should be accepted at their face value. Independent observations would not do anything else than prove the consistency and accuracy of the figures presented. When they heard of a man doing 50,000 Schick tests, it required considerable courage for a man to get up and speak about 5,000 tests. Philadelphia had made a beginning in this work, allowing one man to do the work first and seeing the results. That man would then train others. There would be no value in the work unless the community took it up. There were going to be a great many drawbacks. Many would come back and say that the test was of no value because its fallacy had been shown in this or that individual, so unless they could build a firm foundation by beginning the work with a great deal of care and accuracy the ultimate results would not be satisfactory.



An instance had come under his observation which illustrated the kind of objections that would be raised. A child, supposed to have laryngeal diphtheria, came to Philadelphia from out of town. It had been given antitoxin and did not improve. Dr. Chevalier Jackson had x-ray pictures of the child's chest taken, and within 24 hours the child recovered because a safety pin was removed. In dealing with the problem of a negative Schick, it had been his experience that it was well to take a sample of blood and do a Remer's test as this test was consistent with the Schick test but even better.

DR. E. H. PLACE, of Boston, stated that his experience agreed with Dr. Zingher's as to the value of the Schick test. The Schick test might also be used for diagnostic purposes in very mild cases of diphtheria though he hesitated to speak of it as there might be some danger involved. For instance, a boy who had had his tonsils and adenoids removed a month previously developed symptoms resembling diphtheria. The Schick test was positive showing that he did not have diphtheria. In some cases of prolonged laryngitis of the subacute type, diphtheria had been excluded by the finding of a positive Schick.

DR. ZINGHER, in closing the discussion, warned against using the toxin-antitoxin as a curative agent. This was a dangerous thing to do as the toxin-antitoxin did not cure diphtheria, and immunity did not develop until 2 or 3 months after the toxin-antitoxin was injected.

#### EXPERIENCE IN MORE THAN ONE HUNDRED CASES OF EPIDEMIC ENCEPHALITIS IN CHILDREN.

DR. JOSEPHINE B. NEAL, of New York, gave a brief resumé of the literature relating to epidemic encephalitis. She stated that in this series of cases there were 50 per cent. more males than females; the same was true of epidemic meningitis and poliomyelitis. The seasonal distribution showed the maximal number of cases in the first quarter of the year; meningitis was more prevalent in the spring, April, May and June, and poliomyelitis, in the summer months. In only one instance in this series were there 2 cases in the same family, and these two became ill on the same day. The mortality of the cases under 15 years of age was 28.14; the mortality of those over 15 years was 27.54. The most prominent symptoms were fever, vomiting, headache,

malaise and symptoms referable to the nervous system. Some patients were drowsy, some were delirious. In some instances there were ocular disturbances, diplopia, blurring of the vision, strabismus, nystagmus, convulsive movements of the eyeball, etc. The cranial nerves were most often effected. Catatonia was not infrequent. Kernig's sign was not common unless associated with spasticity. Prolonged cases were less common in children than in adults. Pneumonia was the most dangerous complication. The spinal fluid findings were precisely the same as those in poliomyelitis. The cell counts might be normal but usually were between 100 and 150. There might be a slight increase in albumin and globulin. At the present time we must feel that the etiological factor had not been definitely established. Loewe and Strauss had claimed to have found the exact etiological factor and their work was said to have been confirmed by Leviditi in France. The most common conditions from which encephalitis lethargica must be differentiated were tuberculous meningitis, brain abscess, brain tumor and poliomyelitis of the encephalitic type. The most common sequelae were weakness and paralysis. In this series there were sequelae in 8 adults and 4 children. Changes in speech and mentality were observed in 3 adults and in 10 children. Dr. Frank C. Neff, of Kansas City, Mo., related that recently, within the same week, he had seen 2 children both of whom died. In the first case the child went in a convulsive state apparently out of good health. The physician was puzzled as to whether the child had smallpox because of skin lesions general in distribution. The child died in about 24 hours and they were at a loss to explain the death except on the possibility that it was a case of encephalitis lethargica. During the same week a similar case came under observation. The child went into a convulsive state and died in about 36 hours. The brain was entirely normal but there was an enlarged thymus.

*Discussion.*—DR. GEORGE W. HALL, of Chicago, stated that in their experience in the differential diagnosis between encephalitis and tuberculosis, the cell count of the spinal fluid was not much help. While theoretically in tuberculous meningitis one should find the tubercle bacillus it was at times exceedingly difficult to find this organism. In encephalitis lethargica the sugar content of the spinal fluid was below normal whereas it was normal in tuberculous meningitis.

DR. NEAL, in closing the discussion, said she agreed perfectly as to the increase of the sugar content of the spinal fluid. This was discussed in the paper but the time was too short to permit her to read it. There was also an increase in the sugar content of the spinal fluid in poliomyelitis.

VISUALIZING THE CHILD'S PHYSICAL CONDITION:  
A METHOD ESPECIALLY ADAPTED FOR  
PREVENTIVE WORK.

DR. CHARLES E. CARTER, of Los Angeles, described a method of charting the physical findings comparable to a roentgen ray picture as a basis for corrective work. The charts provided for a periodical health picture which constituted an index of the progress attained. The examination of only the sick child was antiquated and tended toward physical deterioration. This visualizing method was productive of practical results and permitted of any elaboration or adaptation desired. Some such system was very essential for intelligent inspection of the so-called well child. The cards contained the following headings on the left hand margin with sufficient space allowed to tabulate the findings under each: Nutrition, teeth, adenoids, tonsils, chest, abdomen, posture, liver, extremities, appearance, symptoms, rating. Six charts were exhibited demonstrating the graphic inter-relation of etiology and symptomatology in rickets, scoliosis, focal infection, nutritional unbalance, and illustrating the method of charting the first and subsequent examinations. In the course of his talk Dr. Carter stated that he understood a hemoglobin of 80 per cent. was considered normal in the eastern cities; in California this was not the case, the normal there being nearly 100 per cent.

*Discussion.*—DR. C. L. LOWMAN, of Los Angeles, said that if an orthopedist might be permitted to speak he would like to say that he had coöperated with Dr. Carter and wished to emphasize what had been said, namely, that many children who came to them supposedly well were not well from the developmental standpoint. They might be perfectly fine healthy looking children but might have some orthopedic defect which potentially was fraught with great evil, as the child showed in the picture who looked perfectly healthy, but whose ankles were slightly turned in. When he examined that child he had an x-ray picture of the wrist taken according to Rotch in order to study the develop-

ment of the bones in the wrist. This showed that the child was 6 months behind the normal child in respect to the development of his bony skeleton. He sent that child to Dr. Carter who found that the boy was not getting proper diet; his chubbiness simply represented an abnormal amount of fat.

DR. FRITZ B. TALBOT, of Boston, considered the charts very interesting and said they emphasized the importance which was becoming more and more apparent of studying the child and finding defects if they were present before any real harm was done. He thought it was an advantage to have before the eyes of the examiner all the points that were to be taken into consideration, though the careful man was accustomed to examine the child in reference to all those points. However, even the most careful man might occasionally overlook some point and with such a chart one could be sure that the records were complete. All were familiar with the advantage of having complete records for reference in subsequent visits that would call attention to the part of the body that was at fault. He had not had the opportunity to study the charts in detail but in any such mechanical aid it was well to remember that the general impression of the investigator should hold a prominent place in the records. He thought there was danger in putting down individual data of forgetting that one must consider the child as a whole, while he was concentrating his attention on the feature which was at fault.

It was equally important to have an impression of the child as a whole. There was one other thing that should be commented on and that was that to-day we have no normal standards. The standards of normality must be thoroughly classified before we could be sure we were all talking about the same thing. For example, any one could tell whether teeth were carious or not but no group of pediatricists could tell whether a child was normal in respect to height and weight. There would be a great deal of discussion as to whether he was normal or not.

DR. GEORGE E. BAXTER, of Chicago, congratulated the Section on having had its attention called to two things. First, the importance of the so-called normal or well child because he believed most of those working with children as well as those doing general work had failed in that regard. The child was usually only looked upon as a sick child. In order to accomplish something for the well child it was necessary to follow up some sort of a

system similar to that Dr. Carter had outlined. It was an interesting method because it had the advantage of visualizing the condition the examiner should know about. It had value in that when the child returned to the office one could see what the condition was at the previous examination. True enough, many men made careful examinations and recorded the results but not in such an understandable form as this. He felt that these charts were a very distinct contribution to the handling of the well child.

DR. CARTER, in closing the discussion, said that in reference to Dr. Talbot's remark that we had no normal standards, it was with the hope of getting something that might be helpful that he had been keeping these records for the past 3 years. In California, children showed greater height and weight than some series of children in the East if Bowditch's standards of 25 years ago were taken as a basis for comparison. There was the danger of these charts becoming mechanical, but he thought it was thoroughly understood that they were kept in this way only for reference. Dr. Kerley's suggestion in reference to the hemoglobin was of interest. He had said that he considered 80 per cent. normal; it was not normal in California, where there were many children with a hemoglobin percentage of 90 to 100. He had called attention to the difference in certain standards in California as compared with those in the East and he supposed that if some one investigated standards, say in Colorado, they would be found to be different both from those in California and those in the East.

#### FOOD REQUIREMENTS OF THE NEW-BORN INFANT.

DR. HAROLD K. FABER, of San Francisco, contended that the colostrum intake of the infant during the first 2 or 3 days of life was wholly insufficient to supply the needs of the child. The colostrum furnished a scant food supply in consequence of civilized conditions. The respiratory quotient in the new-born showed that the metabolic processes soon exhausted the stored food and body protein and at this time acidosis was not uncommon. In a series of 85 new-born children, complementary feeding was carried out with a suitable modification of cows' milk in quantities limited only by the infant's appetite in order to establish, if possible, standards for maximum food requirement during the early days of life. The formula employed called for certified

cows' milk, 100 c.c.; red label karo, 120 c.c., and 1 per cent. barley water, 480 c.c. The formula gave percentage composition of 14 per cent. sugar; 1.3 per cent. protein and .3 to .6 per cent. fat. The corn syrup furnished a highly hydrolyzed sugar and had given no trouble from the high carbohydrate intake. He had measured the breast milk intake on the first day after birth and found it was about 50 c.c.; it then rose rather rapidly until the fourth day when there was a very rapid rise, the total on the tenth day being 450 c.c. Under this method of feeding, the average gain was 9 grams per kilo of body weight per day. Charts showed the weight curves of 112 infants and presented evidence that with this method of complemental feeding the new-born infants ran a practically ideal weight curve. The additional food was administered so as to avoid any danger of starving the infant, on the one hand, and of lowering the secretory activity of the mother's breast on the other hand.

*Discussion.*—DR. FRITZ B. TALBOT, of Boston, emphasized one point which he said was well brought out in the paper, namely, the importance of fluid in the new-born infant. When one depended upon the breast milk alone the infant did not get enough fluid, and unless the nurse and attendants were specially trained the fluid intake of the infant was neglected. Dr. Faber had also brought out the fact that so-called inanition fever sometimes resulted from too little fluid. The loss of weight in the new-born was of two kinds; one was mechanical as the loss of meconium and urine and the other was because the baby was burning up part of his body tissue to keep himself warm. It was with that idea that Dr. Faber was giving the additional food during the first few days of life and physiologically he was quite justified in doing so, but one could not give any kind of a formula to a new-born infant, and especially dangerous were high fats with whole milk. With this glucose he had seen no trouble, but he had seen trouble from formulas with relatively high amounts of fat. It must be borne in mind that when one figured up the calories per unit of body weight two factors came in for consideration, one was the amount of active protoplasmic tissue which was forming the heat and the other was the part of the body which weighed equally with the muscle and organs, that was the fat and water. Most new babies had relatively the same amount of protoplasmic tissue (at least that assumption had not been contro-

verted) but some infants were born fat and some were born thin and it was not fair to give the same amount of calories to both the fat and the thin baby because the fat was inert and did not form a part in the basal heat production. Fat babies could get along on fewer calories than thin babies and some premature babies required even more calories per kilo body weight than the average new-born infant, so why should there not be this difference in new-born infants.

DR. BERTHA VAN HOUSEN, of Chicago, said she had been interested in trying to supply a more adequate amount of milk during the first few days of life without lessening the secretory function of the breast. She had assembled a milking machine consisting of an electric pump which could be used on both breasts at the same time. They had used it in this way. Every 6 hours the pump was applied to both breasts with the idea of opening up the milk ducts. It was also a sure cure for inverted nipples. It was applied for 5 minutes and the baby was then put to the breast. After the first day, when the baby had nursed, the pump was applied and the breast thoroughly emptied. The mothers all had Wassermann tests. After the third day they usually had a larger supply of milk than was required for their babies, frequently 2 or 3 ounces more than the baby could take. This milk was used for other babies on the first day after birth. This was an ideal plan since, as the mothers were all Wassermann proof, they had no hesitancy in using the milk for other babies. The point to be emphasized was not so much the little device for removing the milk but the fact that with some sentiment or practicality, whichever one wished to call it, the mothers could supply more milk than their own babies required without any trouble and in this way mother's milk rather than cow's milk, could be distributed to babies who needed it.

DR. HARRY LOWENBURG, of Philadelphia, expressed fear lest the giving of the extra milk in the early days of life might encourage the bottle habit. Even if it had a physiological basis he questioned the advisability of giving this form of nourishment. The fault lay in a lack of water and this could be made up in the form of water or glucose without presenting the bottle. He had found that once an infant received the rubber nipple it was difficult to keep it on the breast. He thought they should be slow to adopt this method of giving extra nourishment to new-born

infants. Furthermore, he did not see just why we should try to prevent the initial loss of weight as in spite of that loss children thrived and developed normally. It would be far safer to find a different method rather than to present the bottle. After all their propaganda in favor of breast feeding, if they now advocated this method, they might find themselves in a serious predicament.

DR. LEWIS WEBB HILL, of Boston, agreed with Dr. Lowenburg that Dr. Faber's paper gave the impression that the Lord had made a mistake when he planned that the new-born baby should not eat. The new-born baby was not meant to take much into its body. The colostrum was a concentrated food that met the new-born infant's needs. It was high in protein and low in sugar and one was flying in the face of nature when he attempted to do differently. He did not believe the extra food was an advantage and that the reason little breast milk was furnished was because the intestine was becoming infected with the ordinary bacteria and if it was flooded with extra food a great deal of harm might be done. Czerny thought it was even inadvisable to give sugar and advised only water. Dr. Faber said his babies had been slow in recovering their birth weight. Were they fed at four-hour intervals? If that was the feeding interval it might be that if they were fed oftener they would have regained their weight more quickly. Many had tried to prevent the initial loss of weight, but the only research on this subject was made by Schick who claimed to have prevented loss of weight after birth by feeding breast milk from another woman.

DR. J. I. DURAND, of Seattle, Wash., said that the Lord when he made the plan had in mind a less highly developed nervous system than they were dealing with to-day. The mothers underwent very much less disturbance among primitive peoples than under the conditions of civilization. He thought that Dr. Faber had answered the criticism that had been brought by the fact that his 20 babies had done so well. As to the question whether this complementary feeding would interfere with normal breast feeding, he thought the opposite would occur. The increased vitality and strength of the baby that received the additional food would enable it to bring the breast milk up to its requirements better if it had complementary feeding. Dr. Durand asked Dr. Faber whether he had seen inanition fever in any of those cases.



DR. ROGER H. DENNETT, of New York, said he felt that they ought to be very grateful to Dr. Faber for this paper. He had always said that babies should not have even water for the first 3 days of life, and he had conscientiously believed it, but Dr. Faber had seen these cases and no one had repeated the work so it hardly seemed that they ought to criticize observations which they had failed to make themselves. He asked whether there was any febrile or other disturbance in these babies. He did not understand what percentage of these babies had gone on and been entirely breast fed; he would like to know something on that point. So far as the caloric requirements were concerned there had been no question for a number of years that babies of different nutritional standards required different numbers of calories. He had believed that the average baby needed 50 to 55 calories per pound; the undernourished baby needed from 60 to 65 calories per pound, and the fat baby required from 40 to 45 calories per pound.

DR. FABER, in closing the discussion, said his purpose in presenting the paper was not to advocate a particular method of feeding but to report the results in this series of cases. It was perfectly true that the weight standard of feeding was faulty and so was the method of feeding by body surface. The food demand arose from the amount of activity of the active protoplasm and of that we knew the measure. He believed the only standard by which one could adequately feed a child was by appetite, and that was the method nature used. Dr. Lowenburg brought out the point that the fluids were enough; in his experience the fluids were not enough. In a long series of cases, when given all the water they would take, the babies did not do so well. The religious arguments he acknowledged were difficult to answer, but he could say that man as a civilized animal, had a certain number of maladaptations and these maladaptations occurred in Nature. Of this inguinal hernia was a sample; that occurred when man assumed the erect posture and Nature had not provided proper mechanical support. We could say that Nature certainly had not provided enough fluids. They had lost no babies in this series except one that died of birth injuries. With regard to breast feeding, after the babies left the hospital; they had not been able to hold 100 per cent. of breast feeding, but about 65 per cent. of the babies remained on the breast while in this series the

average was 66 per cent., so they certainly had not reduced the amount of breast feeding by the complement feeding during the first few days. There was only one case of inanition fever, and that baby refused all food.

### THE BREAST AND THE NURSING CHILD.

DR. FRANK H. RICHARDSON, of Brooklyn, stated that recent literature was comparatively bare of observations on the physiology of lactation, that was, in studies of the nursing of healthy babies. He therefore desired to present clinical observation made on 3 normal breast fed babies during the 9 or 10 months each was on the breast. The conclusions based on these observations were: Appetite and thirst of the mother were automatically regulated by the demands of the child on the breast supply; decreasing demands of the baby were met by a decreasing secretion of milk by the lactating breast—this statement was based on observations during weaning and elimination of night feeding; what had been described by mothers as the “coming in” of the milk was a clinical entity, recognized or not by the individual; if long intervals were observed, the nursing baby could not be overfed. These conclusions were based not upon ward studies but upon replies to a questionnaire by nursing mothers. On the second day or thereabout the true milk rushed into the breast and this was often an extremely painful experience to the mother. An attempt was often made to check the amount of milk secreted by applying a binder and giving a cathartic. This line of treatment frequently resulted in drying up the milk. In a study of 200 cases of premature weaning, only 18 were weaned after the first month. That seemed to be the critical period. It was also a mistake to overfeed the nursing mother.

*Discussion.*—DR. ISAAC A. ABT, of Chicago, called attention to the fact that physiological lactation depended upon some external forces and some internal forces. The internal forces might be described or referred to as the “coming in” of the milk. This phenomenon occurred shortly after birth when lactation began and it occurred during lactation when the breast became distended. The flow was dependent upon the internal factors of muscular activity, nervous activity and glandular activity. It was well known that the nervous system had a considerable influence on the milk. The woman under the influence of fear or other psychological

states was frequently unable to nurse her baby. Dr. Abt said he, too, had devised a milking machine and they had found that when the milking machine was first applied the mother showed fear and the supply of milk was inhibited. Finally, when the woman became accustomed to the milking machine the milk would flow freely. Dairymen told him that they had the same experience with the milking machine. Now, referring to the external dynamics, they were dependent upon the sucking action, and this was dependent upon sucking and compression. The breast might be emptied in either way. It was probable that the baby used both suction and compression and that was the better way. They had found that it required considerable pressure, as estimated by an air gauge in the milking machine, to bring about the flow of milk. The amount of compression measured by the air gauge varied greatly under different conditions. Dr. Abt said he wished to emphasize the point that the baby was the best machine for emptying the breast and if a mechanical device was substituted it should be one that provided for both suction and compression.

DR. CHARLES F. WAHRER, of Fort Madison, Iowa, said he had been talking with old Dr. Aristotle the other day, and notwithstanding his great learning he said that "Experience is fallacious and judgment is difficult." In a modern sense that told one how to feed a baby understandingly. He had never met a baby yet who could not stand a little starvation until he had figured out what to do. One need not be in a hurry to get a patent milking machine for he thought the baby would take care of the situation.

DR. W. A. MULHERIN, of Augusta, Ga., said the free expression of opinion during this session showed the importance of having papers as these on the program. He thought complementary feeding had come to stay because it was the most natural way of feeding a baby. It was simple and it was practical. He had been surprised that more men had not taken up Dr. Sedgwick's method of complementary breast feeding. There were a few things that should be stressed that made for success in the use of this method: 1. The proper stimulation of the breast as advocated by Dr. Sedgwick. Put the baby on the breast and after 10 minutes help the baby by compressing the breast with the fingers. 2. Get the mother's cooperation. The mother usually could and would cooperate. 3. The physician himself must be

thoroughly convinced that he could succeed in establishing maternal nursing, and then it was easy work. It was surprising how often one would be successful in bringing up the milk supply if he carried out these 3 points. The practice of stuffing the nursing mother was wrong in principle and wrong in practice.

DR. RICHARDSON, in closing the discussion, said he was glad Dr. Abt had brought out the point that the original inflow of milk was parallel to what happened a number of times a day during lactation. As to the advice derived from the quotation from Aristotle, it was good up to a certain point. It was true that a great many babies, if left alone, would get up an appetite, but there were babies in which the lack of food had led to inanition fever and they had no appetite. What Dr. Mulherin had said in regard to complementary feeding should be emphasized. Complementary feeding was based upon the assumption that the baby would not overfeed on the breast if fed at sufficiently long intervals, and if the baby was not getting enough food he might be fed after he had exhausted the breast supply. As to the length of time consumed in nursing, he thought it did not harm if the baby were allowed to take 40 or 50 minutes in nursing, as he was not eating during all that time.

#### SOME PRACTICAL POINTS IN THE TECHNIQUE OF INFANT FEEDING.

DR. JOSEPH BRENNEMANN, of Chicago, said that the things to which he would direct attention were so simple and elementary that except for the fact that they were of great importance they would be unappreciated or ignored. It was often the very simple things that determined whether a child was normal, happy and mannerly or abnormal, unhappy and ornery. Frequently, when a mother had been a good breast feeder and it came time to wean the baby, it was found that the baby would not take the bottle. She may have abandoned breast feeding while she was making the attempt to have the baby take the bottle and with the baby getting insufficient food from either the breast or the bottle he might be losing weight. The mother might then try feeding the baby with the spoon from a cup, from a hygiea bottle, etc., to find that the baby rejected all these means of obtaining nourishment. The situation was then difficult indeed. It was not the food that the child objected to but the method. The psychology of habit

explained the situation. The baby preferred one food by one method; monotony did not pall upon him. A difficult situation of this kind could easily be avoided by teaching the baby very early in life to take the bottle. This might be done without interfering with breast feeding, by giving a little slightly sweetened water in the bottle after breast feeding. If there was any objection to giving the small amount of sugar in the water, a little saccharin might be added. Even in the second year the baby as a rule would not take as much from a cup as from a bottle. He saw no reason of depriving the child of the bottle and thought the child should be allowed to have the bottle well into the second and even into the third year. The same psychology applied in reference to spoon food. Spoon food in the form of strained vegetables might be given as early as the fifth month. If attention were given to these matters there would be no difficulty in passing from the breast to the bottle and from one kind of food to another. This apparently simple matter might have an influence on the child's entire attitude toward life. The child who would not take the bottle, refused the cup, the spoon and every device, and whose mother spent hours trying to cajole him into taking each new article of food, was liable to become the person with peculiar tastes, who could not eat this, that or the other article of food, and adapted himself poorly in all situations in life.

*Discussion.*—DR. BORDEN S. VEEDER, of St. Louis, said he was much gratified to hear this paper. They now started early to feed babies with cereals and vegetables. He had done nothing in recent years that had given him so much satisfaction as starting in early with spoon feeding. He started at 5 months giving cereals and at 7 months gave strained vegetables. He did not believe in starting with the bottle too early. He did not believe in the child having the bottle for 2 or 3 years as he could see no necessity for it.

DR. MARY T. MOORE, of Boston, called attention to the importance of making sure that the baby was not tongue tied when it did not take the bottle readily. Such a child might be looked upon as cantankerous when the difficulty was a mechanical one.

DR. H. N. APPEL, of New York, stated that they encouraged spoon feeding at the hospital with which he was connected but they dreaded the use of sugar because they saw it cause eczema and green stools. Spoon feeding early placed one in a position

to overcome deficiency in the diet during the first year. They started with one teaspoonful of cereal a day and changed the variety of cereal each day. They instructed the mothers how to prepare the cereal and it was forced down if necessary as though it were medicine. In this way the child soon became adjusted to the spoon.

DR. E. J. HUENEKENS, of Minneapolis, said they fed solid food after the sixth month and from the tenth month on the baby used a cup and solid food. But they went one step further—the babies were put on 3 meals a day when they were 10 months old. This made the care of the babies much simpler. They had carried out this plan for 5 years with a large number of babies.

DR. M. L. TURNER, of Des Moines, said he wished to endorse the three-meals-a-day plan. The children did better on 3 than on 5 meals a day. They had one child fed on 3 meals a day that weighed 30 pounds at the age of 2 years.

DR. BRENNEMANN, in closing the discussion, said he first started giving vegetables and cereals to children at 10 months of age and then gradually worked down to 9, to 8, to 7, to 6 and now to 5 months. He began when the baby was 5 months old with cereal and when it was 6 months old vegetables were given. Until 10 years ago he had followed the teachings in the books and took the babies off the bottle at the age of 13 months and put them on the cup. In his experience it was wholly unsatisfactory. During the last 10 years he had done the opposite, and allowed the child to have the bottle until the fourth year. In his experience it was not true that a baby in the second year would take as much milk as he wanted it to take. As to giving water in a bottle, he did not give much sugar in the water. He only gave an ounce of water and very little sugar. As to the 3 meals a day, he recalled having read a book on children written 60 years ago in which 3 meals a day were advocated at the latter part of the first year. He had never been able to feed a baby successfully on 3 meals a day, though perhaps it might be done. Many babies could perform quite remarkable dietetic acrobatic stunts. During the latter part of the first year and the second year, he preferred to give 5 meals a day. Three meals might be given at the end of the second year, but he thought it a little difficult for children to get along well on 3 meals a day much earlier.

## DIET AS A FACTOR IN THE ETIOLOGY OF ADENOIDS.

DR. FRANK VAN DER BOGERT, of Schenectady, N. Y., stated that little was known of the cause of adenoid and tonsilar hypertrophies, and therefore there was little opportunity for their prevention. Their frequent association with rickets suggested that the same underlying etiological factor might be responsible for both conditions. There was considerable evidence to indicate the dietetic etiology of rickets. It was also quite generally recognized that adenoid and tonsil hypertrophy were associated with digestive disturbances in later childhood. These digestive disturbances frequently persist after the removal of the tonsils and adenoids. Carbohydrate excess frequently was responsible for a catarrhal condition of the digestive tract extending from the mouth to the anus. It was reasonable to believe that such a condition might also involve adenoid and tonsilar tissue. Tissue thus affected was lowered in resistance and fell an easy prey to infection. It was worthy of note that the development of adenoids and hypertrophied tonsils was coincident with the introduction of bottle feeding at the end of the first year. Hypertrophied tonsils and adenoids were frequently found associated with colitis, mucous disease and with enuresis. Of a series of 101 infants artificially fed, 61 showed hypertrophied tonsils and of 65 children breast fed, for more than one year, 51 showed enlarged tonsils and adenoids, indicating that there might be some relation between the prolonged nursing and the hypertrophied tonsils. A sufficiently large number of cases were treated dietetically by restriction of carbohydrates following the removal of tonsils and adenoids to afford a basis for the belief that diet had an influence on the recurrence of tonsil and adenoid growth. Bad hygiene seemed not to be a factor in the causation of adenoids, for, in China where hygienic conditions were notably bad, hypertrophied adenoids and tonsils were rare. The facts seemed to point to the increased consumption of sugar and the unbalanced ration as an etiological factor in tonsil and adenoid hypertrophies.

## REGIONAL SENSITIVITY OF THE SKIN OF NORMAL INFANTS.

DR. LOUIS W. SAUER, of Evanston, Ill., presented this paper, in which he described a number of attempts that had been made

to perfect tests whereby the exudative diathesis might be detected in its latent state. None of these investigators used the same substance on the various regions of the body. The thorax, feet and palms were seldom involved in infantile eczema. The face and buttock were the sites of predilection. Solutions of phenol in benzol were applied to the cheeks, buttock, thorax and soles of 100 normal-skinned infants. The reaction one hour after the application and 24 hours later were compared. The phenol benzol was applied in strengths of 15, 20 and 25 per cent. to the above mentioned sites. At the end of one hour the 15 per cent. solution gave 77 reactions on the cheek, 24 on the chest and 71 on the buttock; at the end of 24 hours there were 27 reactions on the cheek, 3 on the chest and 26 on the buttock. Using the 20 per cent. solution, the cheek showed 97 positive reactions, 44 for the chest and 85 for the buttock; at the end of 24 hours the 20 per cent. solution gave 59 positive reactions on the cheek, 7 on the chest and 47 on the buttock. With the 25 per cent. solution at the end of one hour the cheek gave 98 positive reactions, the chest 65 and the buttock 88; at the end of 24 hours the cheek showed 78 per cent. positive reactions, the chest 21 and the buttock 59. From these results it was evident that the regional difference in the skin must be reckoned with in perfecting tests for the exudative diathesis.

#### THE CLINICAL DIAGNOSIS OF HEREDOSYPHILIS.

DR. HENRY F. STOLL, of Hartford, Conn., stated that the Wassermann test was frequently negative in late heredosyphilis. There were, however, often certain leads in the symptomatology, and careful examination would frequently reveal suggestive physical signs. The cases reported showed that the chief leads might be found in other members of the family. If with care and patience one fitted together these isolated, and in themselves apparently insignificant, data, he would frequently obtain an unmistakable picture of familial syphilis.



# ARCHIVES OF PEDIATRICS

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## OPHTHALMIC ASPECTS OF PEDIATRICS.\*

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It has been said<sup>1</sup> that the future progress of ophthalmology is to be along the lines of internal medicine, and already there has been a tendency to subdivide the tremendous field of the specialty. It seems inevitable that pediatrics will receive more direct attention as the field of ophthalmology is illuminated. A movement has recently been started in England to create a separate eye clinic for children. Whether this is an advantage or not, at least it may be looked upon as a "straw in the wind." Germany has made definite advances and in our own land unlimited appreciation should be extended especially to Dr. Frank Allport for his unceasing efforts for the child's eyes.

\* Read before the Brooklyn Pediatric Society, April 27, 1921.

No attempt is to be made in this paper to consider the *relations* of ophthalmology. Only generalizations of certain *aspects* will be touched upon, that aid, in the early recognition of systemic disease, may be more frequently called in, and that we may all pull together in the up-hill fight for the prevention of blindness. Definite entities have been selected for consideration which offer certain points of peculiar interest and which need emphasis.

The mutterings<sup>2</sup> of the prophylactic fog siren have been heard of late and its wailings suggest, that we must not forget the necessity of vaccination against smallpox. We, of a younger generation, have seldom if ever seen an active case of the old scourge. Perhaps this lack of its visible malignancy may be a real danger to the people. We often feel that the more violent eye infections are likewise apt to be looked upon as a horror of an age gone by and so take a heedless attitude.

*Ophthalmia Neonatorum*,<sup>3</sup> as a term, is used in most textbooks to refer to any infection of the conjunctiva in the newborn and does not constitute an etiological unit. It seems *advisable* to retain this grouping and yet *wisest* to think of it in terms of Neisserian virulence. Such dependable figures<sup>4</sup> as we have are based on this group name. Thus we learn that in pre-Credé days a morbidity of from one to twenty per cent. was expected in the various lying-in establishments. The number made helpless by this condition has a very direct significance for us. In the German asylums for the blind, before this method was used, those rendered sightless by ophthalmia neonatorum represented 30 per cent., afterwards only 19 per cent. As late as 1918,<sup>5</sup> here in our own midst, nearly 23 per cent. forms the proportion of the blind from the same cause. It is evident then that we are too apt to say, "Our generation does better," because we feel that our general understanding of the subject is much broader and our methods more exact.

From an etiological standpoint then it is well to remember that any discharge from an infant's eyes should not only be regarded with suspicion, but vigorous anti-gonorrheal measures must be taken. We really see few cases and so do not have a highly cultured diagnostic acumen. There are varied and often atypical clinical types and we hear reports of "smear negative,"

"smear positive." Remember what Duane and various authors<sup>5</sup> point out—that there are 2 other gram-negative, intracellular diplococci frequently found in eye discharges which cannot be differentiated morphologically but only by cultural means. Remember<sup>7</sup> that the discharge may show no organisms after only a few hours of treatment. In fact,<sup>8</sup> in a certain number of cases, none appear in the discharge at all but can be demonstrated in curettings of the conjunctival epithelium. Although the gonococcus is most to be dreaded, less vicious organisms may be equally destructive. Cases of purulent ophthalmia occur in spite of the most thorough vaginal disinfection. In fact,<sup>9</sup> many cases have been reported showing that the disease had run its entire course in utero and active cases have showed that the disease has run its entire course in utero, and active manifestations discovered at the time of Caesarian section. Ocular infection also occurs in older children, as Arlt<sup>10</sup> has pointed out, more particularly in the instance of gonorrheal vaginitis of little girls.

We are inclined to think of a catarrhal disease as one in which the discharge represents the major feature and though it is perhaps the most evident symptom it stands for very little from a pathological view point. The epithelial and subepithelial tissues<sup>11</sup> are invaded by the organism and pronounced infiltration takes place with marked vascular activity. This accounts for certain of the clinical features and shows why, with separation of the pellicle after the application of nitrate of silver,<sup>12</sup> we are actually removing enormous numbers of the exciting agent. In case of purulent ophthalmia, a close watch by an experienced specialist and well directed nursing are the best safeguards against injury to the cornea with their resulting semi-opaque scars. We see too many cases of catarrhal eye disease where bandages have been applied resulting in conditions highly favorable to the maceration of the tissues and multiplication of the bacteria. The slightest injury to the cornea, when making instillations or cleansing the eye, is almost sure to mean permanent damage, for although some authorities contend that the coccus can penetrate the intact epithelium of the cornea yet abrasion opens a most direct avenue of infection.<sup>13</sup> The greater the swelling and reaction, the greater the danger of complications.

We are lucky, in the field of ophthalmology, in that we have

a number of medicinal agents which have a relatively specific action and others which have very definite and generally accepted indications. To such wonderful purpose<sup>14</sup> have silver nitrate and the silver salts in general been specific that we cannot think of gonorrheal ophthalmia without at once connecting it with the thought of silver nitrate. Moreover, zinc sulphate is particularly destructive to the Morax-Axenfeld diplobacillus and optochin, to the pneumococcus.

In 1884,<sup>15</sup> twenty-four years after he had shown the world how to express a placenta, the obstetrician, Karl Credé, reported his wonderful results by the instillation of a 2 per cent. solution of silver nitrate into the conjunctival sacs of new-born infants. It is perhaps of interest to note,<sup>16</sup> that our present day obstetricians are the loudest complainers against as strong solutions as Credé used. In fact, they not only dilute it with water but go so far as to dilute it with organic matter. In this connection it is of interest to recall that the figures of the German asylums for the blind of 1896 using his method were 19 per cent. and our own comparable figures of 1917 and 1918 nearly 23 per cent. Is there a relation? Perhaps not. Most institutions<sup>17</sup> of to-day show as low a morbidity as Credé himself reported though using weak solutions or the organic salts. Without joining in the controversy, the passive observer has seen these organic salts come more and more into use be it by commercial or purely medical stimulæ.<sup>18</sup>

*Phlyctenular Ophthalmia.*—If the word *pus* carries terror to our hearts, in the first years of a child's life, the word *tear* should be more appalling, at a later period. Lacrimation, as a symptom of corneal irritation, is a warning that impaired vision will follow unless the process is arrested. The tables of Magnus,<sup>19</sup> showing the causes of bilateral blindness between the ages of 1 and 15 years, make it evident that cornea opacity is responsible for the loss of sight in more than half the cases. A study of his tables also shows, that the diseases most apt to implicate the cornea, are much more prevalent during the same age period, than at any other time. The great significance of lacrimation in children is therefore definitely apparent.

So many names<sup>20</sup> have been applied to the condition of phlyctenular ophthalmia as to suggest an indefinite knowledge of its

real character. This is in part true. In fact, "phlyctenule" means a small blister for which the lesion was mistaken by early observers. It is called eczematous because it is often seen in patients the subject of eczema. It is called scrofulous, because of the diathesis with which it is associated and there are other synonyms suggestive of an attempt at etiological classification.

If you will picture a small pimple-like nodule on the white of the eye near the point where the sclera and cornea meet,<sup>21</sup> trailing after it a comet-like tail of injected blood vessels and accompanied by excessive lacrimation and a fear of light, you will have a mental outline of the local process.

The foundation of our future progress must rest on our understanding of the problems of preventive medicine. This nec-

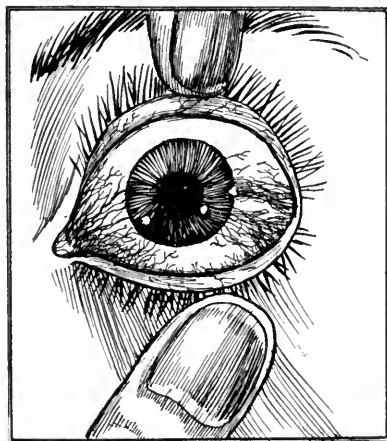


FIG. 1. Phlyctenular Ophthalmia (Modified from May).

essarily places the etiological factor foremost. We are perhaps too ready to rest on our oars when a specific cause for a disease has been demonstrated. The fact<sup>22</sup> that we know so much about the causative agent of tubercular lesions does not mean that the last word has been said as to etiology.

The most authoritative workers<sup>23</sup> are agreed, that phlyctenular ophthalmia is definitely tuberculous in nature, though many valuable contributions<sup>24</sup> have been made, demonstrating the relation of contributory factors which are regarded by many as of primary importance. The microscopical pathology of the phlyctenule is so similar, and the gross changes so closely parallel those

of the tubercular lesions in general, that the identity of the two is not to be doubted. The organism<sup>25</sup> cannot always be demonstrated in the local process. The questions of the associated metabolic disturbances and biochemical reactions are very interesting.

If the pediatricist<sup>26</sup> will familiarize himself with the clinical aspects of phlyctenular ophthalmia, both as it occurs on the conjunctiva and cornea, he will be in a position to interpret nature's local reaction as he would a von Pirquet test, and so have an index of the child's tissue predisposition, as well as a general key to the tendencies. It is not to be understood that the condition means an active tubercular process in the patient, for at times no physical evidence of its presence can be brought out in any way. It is of interest to note, that the history usually shows the child has been directly exposed to the general disease and equally interesting is the fact that the local manifestation is not infectious. There may be enlarged lymphatic glands, foci of infection or nutritional disturbances having a more or less direct bearing.

The eye condition should be under the care of an ophthalmologist. The danger of permanently impaired vision cannot be too carefully guarded against, notwithstanding the fact that inflammatory processes attacking the cornea of children are more amenable to treatment than those of adult life. The underlying systemic derangement suggests its own management.

*Interstitial Keratitis.*—During the latter part of the fifteenth century (1493), when our first real knowledge of syphilis begins and perhaps when the disease first made its appearance, it was evidently<sup>27</sup> of much greater severity than at present. The race's increasing tolerance can be seen in a single lifetime and perhaps this is not entirely accounted for by better therapy. Few of us see what was once a more frequent sight<sup>28</sup>—the horrible running sores, the eaten away features, the visceral disintegration. The eye, and particularly the child's eye, represents as it were, a mirror of the past, reflecting all these hideous changes, and we can actually see every stage of such processes,<sup>29</sup> from earliest infiltration, to final decomposition, going on in the ocular tissues. This is no by-gone or infrequent sight found by a privileged few. Every clinic in the city has them by the dozen.

Harman<sup>30</sup> found that in 1100 cases of blindness in children 34 per cent. were due to syphilis and this necessarily represents but a small proportion of those affected.

Interstitial keratitis is often the first active sign of congenital lues, so that its recognition gives a great diagnostic and therapeutic advantage. Photophobia, lacrimation and a steamy appearance of the cornea, with either signs of local inflammation, may be the introductory picture. The word interstitial signifies that the process affects the deeper layers of the corneal stroma and it is, in part, this deep seated location that demonstrates its systemic origin. The underlying structures are profoundly complicated and both eyes are usually involved, though

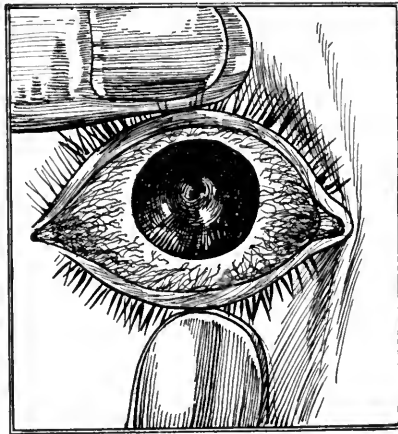


FIG. 2. Interstitial Keratitis (Modified from May).

not necessarily at the same time. Fuchs<sup>31</sup> makes the point that, "Positive evidence of syphilis is afforded in nearly all cases of parenchymatous keratitis by the Wassermann or luetin test. Blood Wassermans on the parents demonstrate the etiological factor in about 80 per cent. of the cases." If the words *family history* could be stamped in red ink across the history records, its relative importance might not be overlooked so often, and many more "errors of omission," removed from the line for diagnosis.

Our treatment<sup>32</sup> and results in the local manifestation are gratifying, considering the marked changes presented but a restoration to useful function is often wrongly taken as a sign

that the general condition may be neglected. Recent pessimistic views as to the curability of syphilis are apt to decrease our interest, particularly in the congenital form, whereas they should stimulate effort.

*Trachoma, Granular Lids, Follicular Conjunctivitis*<sup>33</sup>.—We have had the trachoma horror thrust before us from every angle. The daily press and ultra-scientific journal seem to vie with each other in their efforts to impress us with the seriousness of the subject. Does the general practitioner or pediatricist give ear to either of them? Does he look for the disease and does he see it when he does look? Patients often speak of having had granular lids when a child. To the lay mind granular lids may mean anything

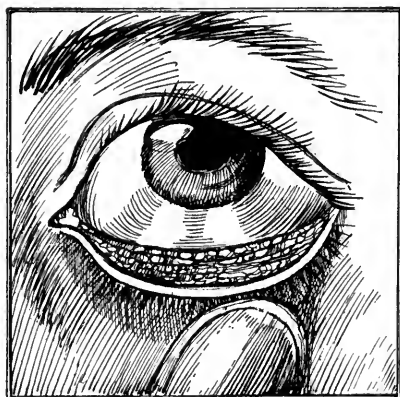


FIG. 3. Appearance of the Lower Lid Due to Follicles (Modified from May).

from the true trachoma to the grainy appearance of the eye-lash line caused by scaly crusts or nits.

Children, who continually blink their eyes, frequently are said to be in the beginning stages of chorea, when the true cause may be seen if the lids are everted. As a symptom, this twitching of the lids may mean trachoma or the benign follicular conjunctivitis. Any degree of follicle formation, from a sugared appearance of the epithelium, to the cobble-stone-like elevations, may signify the beginning of the disease which has brought blindness to so many. Trachoma should be searched for (many cases give no subjective symptoms at first) and not waited for, as is usually done. The same attitude must be taken as is advocated for tuberculosis. The hidden or unrecognized cases are the dangerous ones both to



themselves and to the community. Unhygienic surroundings need not be the only index for examination. It occurs only too often under the best of environmental conditions. From the ophthalmological standpoint, it is valuable to differentiate trachoma from simple follicular conjunctivitis. From the view point of the pediatricist, it would seem best to consider all cases as trachoma until proven otherwise. The one and only sure method of differentiation is by the therapeutic test.

Factors contributing to the etiology of these conditions are of importance. Refractive errors, dietetic derangements and general nutritional disturbances are concerned and their relation must always be considered. We do not know the specific infective agent of trachoma, but we do know that it is transmitted by the secretions. Let the ophthalmologist be responsible for the differential diagnosis, and let him direct the treatment. It is often necessary to precede the tedious and painful applications by expression of the follicles under ether anesthesia.

*Squint.*—The question of squint is apt to carry insufficient interest unless we go further, and seek a clear understanding of just what it means to be cross-eyed. The economic factor is of tremendous importance to the sufferer, and in later life has been a serious and almost unbearable handicap to many an industrious youth.

We see with our brains, of course, and the eyes are the prehensile organs which feel out the various vibratory stimulæ, and respond to those for which they are tuned. Each eye can perceive separately, yet on account of its position in the head, each obtains a slightly different view of the object looked at. It is by the blending of these 2 slightly different images that we gain an understanding of the shape of the object and its relations to the world of perspective. This blending or fusing, as it is called, is again a cerebral act. There must be a certain normal relation of focusing and turning-in of the eyes when a near object is regarded. In all cases of squint, the proper balance of these is lost, but may not manifest itself unless the fusion sense is defective. Mother Nature is a modern creature. She is a staunch believer in the conservation of energy. It is perhaps due to this that she allows one eye to roam, when the desire for fusion is diminished. In fact, she suppresses its function just as the microscopist does

when he looks into his instrument with both eyes open, and yet only sees with the one over the eyepiece. Now picture the result of these slovenly habits of Mother Nature. The deficient fusion sense will atrophy from disuse; the wandering eye will come no more into the line of orderly duty; and the once perfect vision drop into an apathy, from which no one can ever quite wake it.

What is the remedy? Send him to an ophthalmologist when the first inkling of the condition appears. Get your hint from what happened to his big brother, through delay. Don't send him to some near "eye doctor" who will sell him a pair of "rest glasses," or say "wait until he is old enough for operation." The idea is not eyeglasses, but appropriate treatment and an accurate optical correction after the prolonged use of atropine. If we but wait too long, all the eyeglasses, medicines and operations in the world cannot restore the lost function. Help us to educate the dwindling cerebral centers of fusion, help us to get the proper correcting glass on, and keep it there. Help us get the poor little crossed eyes back where they belong, and when you have helped this much, help some more to educate the child's whole family to coöperate and appreciate the necessity for correction. And above all, help us to get in before the last bell rings and the race is lost.

COVER TEST.—Have a suspected case look at your nose, then cover one of the child's eyes with a card and suddenly remove it. Repeat this on the other eye. If a sudden lateral movement is made by either eye independently of the other you have a case which does not belong to you but to the eye specialist.

Ophthalmologists<sup>35</sup> of the country are trying to purify their ranks and get rid of the chaff by taking a series of high standard, voluntary examinations. When the other specialists get to that point, we could almost demand that every man read Worth's little book on "Squint." It is a treasure chest in which even intellects of one syllable can delve with glee and withdraw handfuls of wealth for posterity. Worth has given us his results, after years of study, and has drawn his conclusions, not from hundreds but from thousands of cases. He has taken the guess out of the problem, and given us facts to work with. For instance, he shows that babies can perceive light at birth and can fix a light within a few hours after birth, and can do so steadily by the end

of 2 or 3 weeks. During the first few months of life, the eye movements are uncertain, not being fully under the control of the higher centers, so that the slightest gastric or nervous upset may be sufficient to cause deviation. After one year, however, the eyes can be shown to be fully associated in their movements. The fusion sense is slower in maturing and is not fully established until about the sixth year. These few points alone make it obvious that if we are to prevent the degeneration of centers, end organs and muscular balance, we must begin correct and supportive measures before the time limit of development has been reached. Worth's tables show the rate at which the degeneration progresses, and consider the age of the child, the duration of the squint, and the amount of deterioration of vision. As an illustration, the majority of the cases presented are between the ages of 1 and 3 years. He examined 409 of these, and found that where the squint had been continually present for less than one eighth of the child's life,<sup>12</sup> only 62 retained normal vision in the deviating eye, and in those in which it had lasted for more than half of their lives, there were but 3 who could see a normal amount. He gives very carefully worked out figures on the number of school children showing squint but for our purpose a rough practical figure of 25 per cent. leaves a startling impression. The fundamentals of the problem are, of course, but barely outlined here; a mere suggestion of the symptoms is touched upon. The treatment is essentially the specialist's and is directed as the findings of the particular case indicate. The objects in general are—"To prevent deterioration of the vision in the deviating eye and restore, as far as possible, the sight in cases in which amblyopia from disuse has already been allowed to occur (Worth considers congenital amblyopia a rarity); to endeavor to remove the fundamental cause of the squint by training the fusion sense at the earliest possible age; to restore the visual axes to their normal relative directions."

*Defective Vision.*—People who have worked with the blind have often been wonder-struck by their ability to avoid objects. This peculiar faculty is variously developed in different subjects. The case<sup>36</sup> is now and then cited of a blind person being able to describe the structure of a fence or wall before him, tell something of its dimensions and of the material of which it is built.

Or perhaps he can tell whether a pail is made of metal or wood and whether it is full or empty. Many<sup>37</sup> of the unicellular organisms, such as the bacteria, protozoa and so forth, exhibit a sensitiveness to light for their whole body. Whether or not some remnant faculty still remains dormant in our skins awaiting cultivation is yet undecided and at best offers but a clue to the solution of the problem. We know that in its simplest form the visual organ may consist of an epithelial cell<sup>38</sup> and its associated nerve fiber. It necessarily follows that defective visual function may arise from processes directly or indirectly affecting the cell, the fiber or the center to which the fiber goes. The enormously complex mechanism which has evolved from this simple structure is nevertheless resolvable into its primitive units for generalized consideration. It is in this analysis that we realize the importance of the psychic factor and more particularly so in our work with children. We can follow their processes with more comprehension perhaps than when years of residual impressions have obscured them in an unrecognizable haze. It is essential then that we weigh each child's psychological component so that we may work with and not against it. We surely need what little help a child can give, for, after all, the methods of obtaining the total visual acuity are subjective though we can measure the functional value of the end organ objectively. Serious efforts to safeguard the visual function are a product of our own generation, though feeble attempts may be seen at various ages and in savage tribes of our own times. A series of pamphlets<sup>39</sup> on the "Conservation of Vision," have been published under the auspices of the American Medical Association, which present the present national attitude toward the subject and which outline a program worth heeding. The broad topics of ocular hygiene at home and in the school are of vital interest but the more restricted subject of the conservation of the child's eyes includes our present discussion of "Defective Vision."

It is through the coöperation of the family, the school and the pediatricist that the ophthalmologist expects to reach the sufferer at a time when his efforts will be most effective. Yet you, as physicians interested especially in children, do not seem to take as energetic an attitude or as much responsibility as your position demands. As detectives in searching out ocular misdemeanors,

it is discouraging to note how much more successful is the loving care of a relative or the severe exactions of the pedagogue.

It<sup>40</sup> has been pointed out that babies perceive light at birth

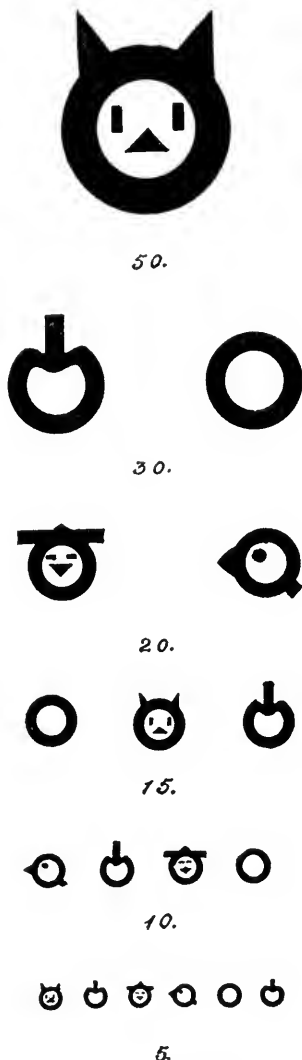


FIG. 4. Optotype for Young Children.

and can fix a light a few hours later. We have quite frequent occasion to apply so simple a test, particularly on "first babies,"

for many a young mother is alarmed because her infant does not seem to notice her.

A little later, the "ivory ball test" of Worth is useful and surprisingly accurate. It consists in tossing the little white spheres, graduated in size from one half to one and one half inches in diameter, before the child and noting his response for various distances.

When a child<sup>41</sup> is old enough to express his visual interest by articulation, charts are made use of. The child's psychological state has been disregarded to an astounding degree in the application of these chart tests. In many instances the charts adapted to adult illiterates are applied unhesitatingly and though it must be admitted that a general conception of their visual acuity may be worked out they need and merit a more direct appeal. A glance at a number of the charts in general use will at once make apparent their inadequacy and lack of consideration for the infant intellect. It<sup>42</sup> was in an effort to overcome the deficiencies of these charts that the author worked out the "Optotype for Young Children," which was described in June, 1919. One of the foremost authorities of the country has said that of all scientific tests our methods of taking the visual acuity are the least scientific. With a full realization of this, the optotype was presented only as a step upward and not in the belief that even a permanent advance had been made.

In a review of previous work<sup>41</sup> along these lines it was apparent that in each instance some preconceived opinion or theory had been at work and that the resultant product of an adult mind was foisted upon the child. Determined to avoid this element, as much as possible a study was first made of children's original drawings. Resource<sup>43</sup> was had to contests in juvenile magazines, a number of children of appropriate age were induced to draw pictures, reference was made to certain studies of children's drawings, notably those of Sully, Shinn, Brown, Lukens, etc., and to other books dealing more indirectly with the subject. The resulting collection<sup>44</sup> represented a child's written language, not his artistic efforts as picture writing did in an early period of man's evolution. This review covered data drawn from over 3000 pictures made by children ranging in age from 2 to 8 years. A process of elimination was undertaken, for it was found that many

of the representations could not be reconstructed according to the geometric principles demanded by the laws of optics and still retain their easily recognizable and characteristic qualities. Those conforming most nearly to the international standard—the interrupted ring of Landolt—remained. A number of charts containing these were made to determine which the child could select most accurately. After many trials, a series of 5 figures was used in the construction of the chart. Thus it is that the optotype was worked out by children of an age it was to test and represents a child's interpretation of objects which interest him most. Many instructive features developed as the chart was evolving which were very interesting from a psychological standpoint. Thus, in the fall of the year, many called the chart-figure of the man's head a pumpkin, being influenced by Halloween suggestions and, later in the year, called it a man or monkey. The peculiar psychological qualities are again evident in criticisms made by adults, for many of them have either progressed so far from the infantile psychologic state or lack imagination to such a degree that they can see no likeness to any every-day object in the figures. After all, it is a creation of children and only a child can fully interpret it. The little slips provided allow the mother to teach the name of the figure. This may be done or not as seems best to the examiner but allows any child to read as readily and accurately as an adult.

As soon as a child knows his letters<sup>45</sup>, which may be quite late, particularly when he has been taught by the word method, the Snellen test type are used. You then are to be held responsible for the discovery of defects of vision.

It is stated that 30 per cent. of the children in the schools of New York City are 2 years behind their proper grades. Dr. Cronin<sup>46</sup> examined a class of 150 defectives and among them 13 had impaired vision. By correction of the nose, throat and eye conditions he enabled these defectives to catch up to children of their own age. This is a classic illustration of what injustice may be done.

Just<sup>47</sup> what we do when we refract and how accurately we do it is a question which not only every ophthalmologist but every general practitioner should be able to explain. Consider the normal eye as representing a sphere. One which is relatively

too small is far sighted, one too large, near sighted. A lopsided eye illustrates astigmatism. In refracting we make 2 kinds of measurements, one to determine the size of the sphere, the other to determine the degree of lopsidedness. A diametrical or axial measurement gives us the size and is what concerns us most in testing for errors of refraction. Within the eye is the mechanism for focusing and through its action an eye which is relatively too short may appear normal or too long. In other words, due to its magnifying or drawing near action or to its minifying or lengthening effect the true measurements may be deformed. Ordinarily we measure the axis of an eye to within one twelfth of a millimeter (the ophthalmoscopic equivalent of one quarter of a diopter and equals about one three-thousandth of an inch), and this focusing apparatus can cause a miscalculation of many millimeters. It is evident that if we are to have these micrometer-like measurements dependable we must rule out its powerful influence. There is only one positive way of accomplishing this. A complete but temporary paralysis is induced by the use of atropine sulphate.

The second measurement for astigmatism is of surface curvature and must consider the lens within the eye as well as the corneal without. We see an elaborate instrument pictured on the sign boards—the ophthalmometer—which certainly makes the impression on the lay mind hoped for by the advertiser. Patients often ask if it is an x-ray apparatus, etc. This instrument measures the degree of surface deformity of the outside of the eye, only often giving very misleading results. The shadow test or retinoscopy, a development of our own generation, is the most dependable and accurate of all objective tests. It raises our work to almost the level of mathematical precision and, particularly in the case of children, allows us to work quite independently of them. The retinoscope is merely a small mirror with a peep-hole in it. The precision originates on the examiner's side of the aperture, for it takes months of patient work to gain proficiency in its use.

Like other tissues, when in a stage of active development, the eyes are particularly susceptible to damaging influences and a realization of this will enable us to appreciate the great necessity for protection and conservation. Puberty may convert a case



of simple myopia into a malignant process rendering the child practically blind and though unlike these oversized eyeballs the farsighted eye does not go blind by an increase of the condition, yet uncared for cases certainly predispose to disease which leads to the destruction of vision.

Children<sup>48</sup> as young as 6 months are taught to wear glasses as they are taught to wear clothes and practically no case has ever been reported where an eye was injured from breaking the spectacles.

SUMMARY.—Besides stimulating a more acute interest in the ophthalmic aspects of your work it is hoped that this paper will leave certain definite impressions:

1.—Take the ultra-precautious attitude towards a discharge from a child's eye.

2.—Lachrimation, as a symptom, must be regarded seriously and very often it is a symptom of a morbid process of systemic significance.

3.—Routine examination of a child's lids is often a very valuable diagnostic aid both from the standpoint of internal medicine and of ophthalmology.

4.—It is almost criminal if squinting children do not have proper attention in the early stages of their calamity.

5.—Errors of refraction can and must be accurately corrected at the very earliest age.

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OPHTHALMIA NEONATORUM BEFORE BIRTH (*Lancet*, London, Jan. 15, 1921). Five minutes after birth of a baby, Dundas noted that it had ophthalmia neonatorum. The lids were red and edematous, and pus was discharging from both eyes. The case was evidently one of intra-uterine infection made possible by the draining away of the liquor amnii, and presumably the presentation had been a brow converted into an occipital during labor. The child died on the tenth day. On removing the calvarium, extreme intracranial congestion was found. The sinuses were full of fluid blood, and injection of the pia mater was intense. When the brain was removed a purulent exudate was found on the middle of the base of the skull extending from the optic commissure backward. There was no disintegration of the globe of either eye. The secondary condition was evidently due to infection by blood or lymph stream.—*Journal A. M. A.*

## CLINICAL AND EXPERIMENTAL STUDIES ON LACTATION AT THE UNIVERSITY OF MINNESOTA.

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Dr. J. P. Sedgwick has requested me to outline the general scope of the experimental studies of lactation now in progress at the University of Minnesota, including a résumé of the investigations already carried out which serve as a basis for this work. Breast feeding has been the subject of careful clinical investigation in the Department of Pediatrics at the University of Minnesota for some years past. Through the agency and the organization of various societies and groups there has been carried out successfully an extensive program of education among mothers in matters of breast feeding. Careful recording of the results of this work has resulted in the accumulation of a vast number of valuable statistics, the compilation of which, with other available statistics, has revealed many very important points. Besides showing the great importance of breast feeding as a factor in decreasing infant mortality, these statistics have demonstrated very clearly to what extent the establishment, maintenance and reinstitution of breast feeding in woman can be influenced and controlled. In other words, the one general fundamental principle that the mammary gland is a very versatile organ and functions according to the demand made upon it has been well proved by clinical methods.

Articles already published describe in detail the various phases of this clinical, statistical and experimental study. As limitation of space forbids a more detailed summary of this work and the results obtained, the reader is referred to the original publications for further information:

*Rudd, Nathalie C.*: Breast Feeding in Minneapolis. *Mother and Child* (1921), 2:171-173.

*Sedgwick, J. P.*: (1) Maternal Feeding. *American Journal of Obstetrics* (1912), 66:857-865. (This constitutes a plea to the physicians of the United States for a united stand on maternal feeding and contains the report on a number of questionnaires

written to the physicians of the Northwest and to the American Pediatric Society inquiring about their experience and success in breast feeding with their own children. Eighty per cent. of the wives of these physicians nursed one child 3 months or longer.)

(2) Establishment, Maintenance and Reinstitution of Breast Feeding. *Journal of the American Medical Association*, (1917), 69:417.

(3) A Preliminary Report of the Study of Breast Feeding in Minneapolis. *American Journal of Diseases of Children*, (1921), 21:455-464.

*Sedgwick, J. P. and Fleischner, E. C.*: Breast Feeding in the Reduction of Infant Mortality. *American Journal of Public Health* (1921), 11:153

A recent statistical study of infant mortality in Minneapolis by Dr. W. S. Bowers, Fellow in Pediatrics at the University of Minnesota, has yielded some very interesting results. The number of deaths from gastrointestinal diseases in infants during each month for some years past was ascertained from the official records. Curves were then plotted for infants under 1 and 2 years of age as shown in Figs. 1 and 2. The charts are self-explanatory. It is to be noted that the curve for 1917 shows some change, while in 1918 and thereafter the peak of summer mortality is lost. Although the organization of the breast feeding investigation as a bureau was not completed until October, 1918, the activities in breast feeding in the Department of Pediatrics had been especially active since 1917. This indicates the great importance of breast feeding in the prevention of gastrointestinal diseases. Further study of this subject from various points of view is desired.

The general principles of lactation may be proved quite satisfactorily by clinical investigation only. Still, it is well recognized that in any line of research, and especially in clinical research, one should substantiate such finding by all means possible. In a problem dealing with the variation in functional activity of a gland it is highly desirable to follow, by means of controlled experiments and histological sections, the structural changes taking place parallel to the functional changes and thus to check up one's results. This not only serves to corroborate and lend

weight to the clinical findings but also usually discloses additional important facts and always suggests new lines of investigation. A series of studies on the mammary gland has been undertaken with the idea of learning more concerning the changes in secretory activity which may be brought about by experimental means.

The judicious selection of the animal to be used in any line of experimental research is of prime importance. The ideal in this work, of course, would be to use the human mammary gland but it is obvious that this does not lend itself to practical application, especially in certain phases of the work. A laboratory

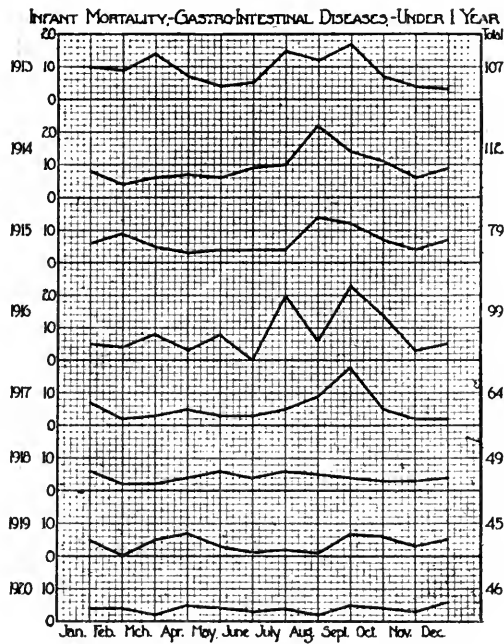


FIG. 1.

animal best suited to our needs must then be selected as the next best choice. The white or albino rat (*mus norvegicus albinus*) gives promise of being well adapted to this work, especially here at the University of Minnesota for various reasons as set forth below. It is well to discuss here in some detail the considerations which led to this selection of the white rat, not only to make more clear the reasons for this choice but also because many of these considerations bear closely upon the problems to be

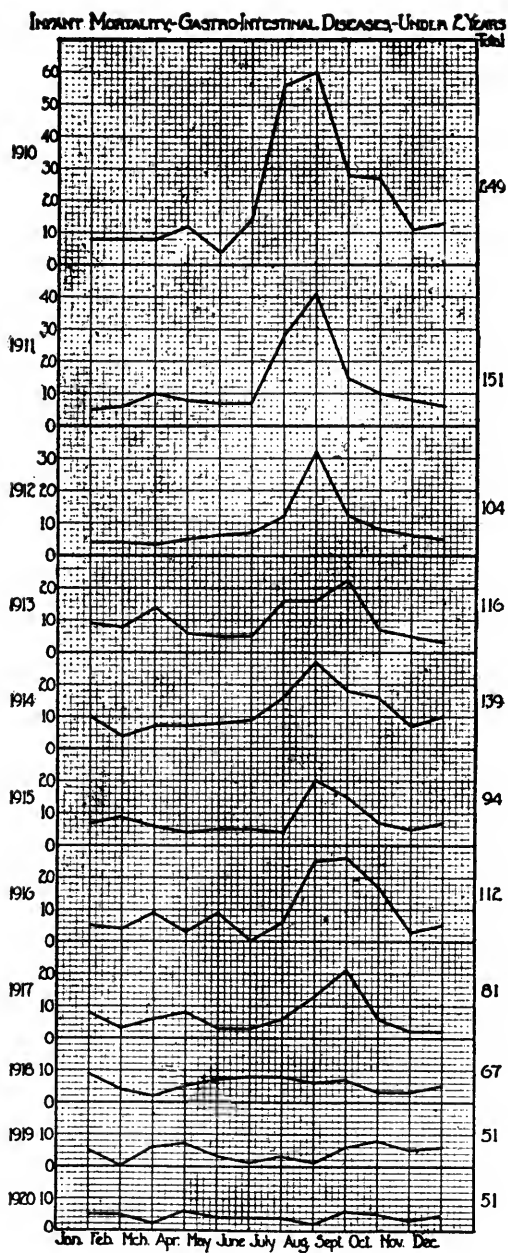


FIG. 2.

undertaken and will needs be referred to repeatedly in the exposition of these problems.

The albino rat is the animal of choice for the investigations which we propose to undertake for the following reasons:

1. The albino rat is a relatively inexpensive laboratory animal, both in original cost and in upkeep. It thrives well in small cages in captivity and upon a fairly simple diet. It is also a very hardy animal and requires but little care.

2. The albino rat adapts itself to scientific investigation. With a little care, it becomes quite tame and is easily handled. Its life cycle is short. It attains sexual maturity at about 10 weeks of age, has a period of gestation of only 3 weeks duration, and gives birth to large litters (average 6 or more per litter). It has usually a period of lactation of only 3 weeks, at the end of which time the litter is quite capable of separate existence. Moreover, the albino rat is born quite immature, a point of considerable importance in relation to our present work. Another point of importance is the fact that the rat possesses mammary glands of convenient size for study, the cross-section of a whole gland being small enough to be mounted in numbers upon the ordinary glass slide used for histological sections.

3. The albino rat has been widely used for scientific investigation and in some respects has been more carefully studied than any other animal. Too frequently it happens that experimental work is of little value because the normal structure and variation of the animals used is imperfectly known.

Through the work on growth by Donaldson and his associates we have for our use accurate reference tables and data on the normal growth of the rat. A large amount of work upon the rat under normal and experimental conditions has also been done recently in the Department of Anatomy of the University of Minnesota in various investigations (including several upon the mammary glands) as shown by the following partial list of publications during the past 6 years:

*Hoskins, E. R.*: The Growth of the Body and Organs of the Albino Rat as Affected by Feeding Various Ductless Glands (Thyroid, Thymus, Hypophysis and Pineal). *Journal of Experimental Zoology*, (1916), 21:295-346.

*Jackson, C. M.*: (1) Effects of Acute and Chronic Inanition Upon the Relative Weights of the Various Organs and Systems of Adult Albino Rats. *American Journal of Anatomy*, (1915), 18:75-116.

(2) Changes in the Relative Weights of the Various Parts, Systems, and Organs of Young Albino Rats Held at Constant Body Weight by Underfeeding for Various Periods. *Journal of Experimental Zoology*, (1915), 19:99-156.

(3) Effect of Inanition Upon the Structure of the Thyroid and Parathyroid Glands of the Albino Rat. *American Journal of Anatomy*, (1916), 19:305-352.

(4) Effects of Inanition and Refeeding Upon the Growth and Structure of the Hypophysis in the Albino Rat. *American Journal of Anatomy*, (1917), 21:321-358.

(5) The Postnatal Development of the Suprarenal Gland and the Effects of Inanition upon its Growth and Structure in the Albino Rat. *American Journal of Anatomy*, (1919), 25:221-289.

*Jackson, C. M.*, and *Stewart, C. A.*: (1) The Effects of Underfeeding and Refeeding upon the Growth of the Various Systems and Organs of the Body. *Minnesota Medicine*, (1918), 1:403-414.

(2) Recovery of Normal Weight in the Various Organs of Albino Rats on Refeeding after Underfeeding from Birth for Various Periods. *American Journal of Diseases of Children*, (1919), 17:329-352.

(3) The Effects of Inanition in the Young upon the Ultimate Size of the Body and of Various Organs in the Albino Rat. *Journal of Experimental Zoology*, (1920), 30:97-128.

*Maeder, L. M. A.*: Changes in the Mammary Gland of the Albino Rat during Lactation and Involution. (Ready for publication.)

*Myers, J. A.*: (1) Studies on the Mammary Gland. I. The Growth and Distribution of the Milk-ducts and the Development of the Nipple in the Albino Rat from Birth to Ten Weeks of Age. *American Journal of Anatomy*, (1916), 19:353-389.

(2) Studies on the Mammary Gland. II. The Fetal Development of the Mammary Gland in the Female Albino Rat. *American Journal of Anatomy*, (1917), 22:195-223.



(3) Studies on the Mammary Gland. III. A Comparison of the Developing Mammary Glands in Male and Female Albino Rats from the Late Fetal Stages to Ten Weeks of Age. *Anatomical Record*, (1917), 13:205-206.

(4) Studies on the Mammary Gland. IV. The Histology of the Mammary Gland in Male and Female Albino Rats from Birth to Ten Weeks of Age. *American Journal of Anatomy*, (1919), 25:395-435.

(5) Studies on the Mammary Gland. V. The Effect of Inanition on the Developing Mammary Glands in Male and Female Albino Rats from Birth to Ten Weeks of Age. *American Journal of Diseases of Children*, (1919), 17:311-328.

(6) Studies on the Mammary Gland. VI. The Development of the Mammary Gland from its Earliest Appearance until the Period of Pregnancy. *American Journal of Diseases of Children*, (1919), 18:4-13.

*Myers, J. A. and F. J.:* (1) Studies on the Mammary Gland. VII. The Distribution of the Subcutaneous Fat and its Relation to the Developing Mammary Glands in Male and Female Albino Rats from Birth to Ten Weeks of Age. (Abstract). *Proceedings, American Association of Anatomists, Thirty-fifth session. Anatomical Record*, (1919), 16:159-160.

(2) Studies on the Mammary Gland. VIII. Gross Changes in the Mammary Gland in the Female Albino Rat during the Period of Involution. *Proceedings, American Association of Anatomists, Anatomical Record*, (1921), Vol. 21, No. 1, p. 74.

*Roberts, F. L.:* Changes in the Mammary Gland of the Albino Rat during the Second Half of Pregnancy. The Graduate School of the University of Minnesota, Papers from the Mayo Foundation for Medical Education and Research and the Medical School, (1921), Vol. I. (In press).

*Stewart, C. A.:* (1) Growth of the Body and of the Various Organs of Young Albino Rats after Inanition for Various Periods. *Biological Bulletin*, (1916), 31:16-51.

(2) Changes in the Relative Weights of the Various Parts, Systems and Organs of Young Albino Rats Underfed for Various Periods. *Journal of Experimental Zoology*, (1918), 25:301-353.

(3) Weights of Various Parts of the Brain in Normal and

Underfed Albino Rats at Different Ages. *Journal of Comparative Neurology*, (1918), 29:511-528.

(4) Changes in the Weights of the Various Parts, Systems and Organs in Albino Rats kept at Birth-weight by Under-feeding for Various Periods. *American Journal of Physiology*, (1919), 48:67-78.

The great advantage of using an animal which has been the object of such careful and extensive investigation, as outlined above, cannot be overestimated. The accurate data thus accumulated on the normal rat enable one to check up with certainty the condition of rats used in experimental work. The extensive experimental investigations of Jackson, Stewart, and Myers on the effects of inanition upon the rat serve as a basis for future experimental work. Finally, the work of Myers, Roberts, and Maeder in establishing the normal development of the mammary gland in the rat is fundamental to any further investigations upon lactation in this animal. Myers, in his series of studies on the mammary gland, has followed the development of the gland from the earliest fetal stages up through the period of adolescence or up to 10 weeks of age; Roberts (1921) has followed the changes in the gland during the latter half of pregnancy; while the work of Myers and Myers (1921), and of Maeder (*loc. cit.*) carry the gland through lactation and the period of involution following the cessation of lactation.

The work of Myers and Myers (1921), and of Maeder (*loc. cit.*) on the mammary gland during lactation and involution are so closely related to the problems to be undertaken that a brief summary of the results of these studies is desirable. Myers and Myers (1921), using cleared preparations, were able to demonstrate macroscopic changes in the mammary gland during the period of involution following the cessation of normal lactation. At the end of 6 hours, the masses of glandular tissue were found considerably enlarged. They explain this enlargement as probably due to the accumulation of milk, and found that it continued through the 48-hour stage. In the 4-day stage, the masses of glandular tissue had decreased considerably in size, while at the end of 5 days the glands are not more than one half the size of those taken at 48 hours. In the stages taken at the end of 2 and 3 weeks, the glands very closely simulated those of adult virgin animals.

Through my study of the mammary gland in the rat during lactation and involution, I was able to arrive at the following conclusions concerning the relative condition of the gland during these periods:

1. The macroscopic and microscopic structure of the mammary gland remains practically the same throughout the normal period of lactation in the albino rat.
2. The mammary gland shows very little change during 48 hours after weaning. The alveoli probably tend to become somewhat more distended by the accumulation of secreted milk.
3. The secretory activity does not seem to be diminished before the third day after weaning. The cessation of secretion varies in different individuals and in different parts of the gland. Eight days after weaning no secretory activity is apparent.
4. A progressive increase in stroma and decrease in parenchyma takes place after the second day, the gland usually approaching the condition of the normal resting gland by the ninth day.
5. At the terminal stage of involution, the structure of the mammary gland is very similar to that of the resting gland in the adult virgin.
6. The mammary gland is subject to considerable variability in rate and character of involution, either in different individuals or in different parts of the same gland. The former may be due to variation associated with the estrus cycle.

For further details, technique, et cetera, the original papers above cited may be consulted. The internal genitalia of the same animals used in this investigation were taken by Dr. H. L. Osterud, and will be the subject of careful volumetric and histological study. It will be interesting to note whether there is any demonstrable structural correlation between the ovary and mammary glands during these periods.

The above investigations have proved quite satisfactory to demonstrate the general histological structure and a fair amount of cytological detail. Upon the basis of this preliminary work it is now proposed to carry out jointly by the Department of Pediatrics and the Department of Anatomy further experiments upon lactation in white rats, in order to throw light upon various

questions of clinical importance in this connection. The work proposed includes several definite problems as follows:

1. *The establishment of a norm* for the mammary glands of the rat during lactation and the various periods of involution. A summary of the results of this work has been given above. This work is now being completed and will be published in the near future.

2. *Involution of a part of the glands.* The proof as to whether or not in the same animal a portion of the mammary gland (or one of the 6 pairs), when the nipple is covered so as to prevent suckling, will undergo normal involution independent of the remainder of the gland kept in full secretion by the normal suckling. Observations in other animals give promise that in the rat the mammary gland upon which no demand is made will involute practically normally. Kuramitsu and Loeb, (*American Journal of Physiology*, May 1921), have noted this phenomenon in the guinea pig. Removing the litter and again replacing after the breast is involuted is impractical in the rat because (as Dr. Myers has observed), the mother, in the great majority of cases, will not permit the litter to suckle her again.

3. *Reinstitution of lactation.* It is obvious for the reasons above stated that this phase of the work cannot be worked out in the rat unless problem (2) gives the expected results. Providing the non-used gland will undergo normal involution, it will be attempted to stop this process of involution at various stages by uncovering the gland again and allowing the litter to nurse it. It will be very interesting to note just when and how the process of involution is affected or arrested by the stimulus and how lactation is reinstituted.

4. *Prolongation of the period of lactation.* An attempt will be made to extend period of lactation beyond the usual normal period of 3 weeks for the rat. The mother will be continually supplied with new litters of small rats unable to subsist without suckling as her own and other litters become too mature to insure nursing. This phase of the work is now well under progress, several of our rats having already nursed litters for 7 weeks. Previous observation indicates that in some cases, at least, the period of lactation in the rat may be extended over several weeks, or 2 or 3 times the normal. In view of the fact that in

some countries lactation is continued in the human breast for 3 to 4 times the arbitrarily established 9 month period in this country, it will be interesting to see how far beyond the usual 3 weeks, lactation can be prolonged in the rat.

5. *Interrupted lactation.* A number of mothers who refused to nurse their litters were encountered during the collection of the series on normal lactation and involution. The mammary glands of these animals were carefully preserved for histological study. It will be interesting again to see whether there is any structural change present in these glands which might suggest the reason for the failure of these rats to nurse their litters.

In connection with the experimental work above outlined, a histological study of the normal human mammary gland will be made, as far as opportunity permits. This work will be carried on in the Department of Pathology, with the coöperation of Dr. E. T. Bell. In suitable cases material will be obtained from mammary glands of the females coming to autopsy. Sections will be made and carefully studied in the hope that we may be able to learn more concerning the structure of the normal gland, both in the resting condition and in the various stages of activity.

While one can never safely predict the outcome or results of research work in any line, it is hoped that with the generous coöperation and assistance of Dr. Sedgwick on the clinical side and with the valuable aid, advice and criticism of Dr. Jackson and Dr. Bell in the working out of the problem, we shall be able to carry out the work as planned and perhaps to contribute something of value in connection with this subject, which is of such fundamental importance to the welfare of the human race.

## BREAST FEEDING IN PRIVATE PRACTICE UNDER IDEAL CONDITIONS.

BY MATHILDA CARLSON, R.N.

Formerly Nurse on the Staff of the Breast Feeding Investigation Bureau of the  
Department of Pediatrics of the University of Minnesota.

During the number of years that it was my privilege to be associated with Dr. Sedgwick in his private practice of pediatrics, the importance of breast milk and breast feeding became strongly impressed upon me. With it came the questions, why were so many babies taken from the breast, and what could be done to prevent it? In going over the records there seemed to be very few legitimate reasons for having taken the baby from the breast and many mothers admitted that they had made no special effort to keep up the breast milk supply.

The work done in 1919 and 1920 by the University of Minnesota Breast Feeding Investigation Bureau, of the Department of Pediatrics, has proven conclusively that a large percentage of these babies can be kept at the breast by a little timely advice and a few simple suggestions to the mother. This work, being carried on now, to a certain extent, by the Infant Welfare Society of Minneapolis, has markedly increased the number of breast fed babies, and also, as statistics will show, decreased our infant mortality.

The Infant Welfare workers, however, are not able to come in direct contact with the mothers as early as is desirable for the best results. Also, there is a group of people often referred to as the "upper, or well to do class" who do not, as yet, take kindly to visits or suggestions from welfare or social service workers. Physicians and nurses who do come in contact with this group find many children who are underweight and who show malnutrition both in infancy and early childhood. During the past year and a half, I have come in contact with many mothers and children of this group. My work with them has been highly appreciated, and the results very gratifying, especially along the line of breast feeding.

My present employer, who has in his general practice delivered these mothers, has made it a part of the routine that I see them and their babies shortly after the child is born to give such in-

structions as may be needed and to see these babies at regular intervals or whenever necessary throughout their infancy.

So successfully has this plan worked that every infant supervised in this manner has been breast fed from 4 to 10 months. Out of 72 cases seen, only 2 needed additional food from birth; both of these were partly breast fed 5 and 8 months respectively. Five more were given additional food during the third, fourth and fifth months. *For 4 months 100 per cent. were at the breast, and 88.5 per cent. were entirely breast fed 6 months.* At this time we usually begin to add gruels, or well cooked cereals and if the child is well nourished and up in weight omit the fifth or 10 p. m. feeding, as a healthy, normal child usually sleeps all night.

Only 3 infants were taken from the breast before the fifth month. 55 per cent. were nursed 9 months longer.

One of the mothers, whose infant had additional food from birth, would undoubtedly have been recorded as never having any breast milk had it not been for her own and her nurse's faithful, persistent efforts. The milk was slow in coming. At 5 days the weighing of the baby before and after being put to the breast showed nothing. Manual expression produced a drop now and then only. At 3 weeks, the baby got 15 to 20 grams at a nursing. The milk gradually increased up to 2 months when he would get about 300 grams a day. About this time the baby began to discover that his food came more easily from the bottle and therefore would not nurse the breast more than 3 or 4 minutes, or while the milk came freely. The mother expressed her breasts and kept up the supply until the baby was almost 5 months old.

The other baby, who had additional food from birth, was a high forceps delivery at a little more than 8 months, the mother having eclampsia. This baby was partly breast fed almost 9 months.

*All babies born so far this year are still at the breast—(June 16, 1921).*

These mothers are not a selected group, neither have all the births been normal, but nearly all of them have had competent medical supervision during pregnancy.

Approximately 24 per cent. of these babies were born to young

mothers (primiparae) who, previously to their marriage, had had only such responsibilities as college and social life call for. I have encountered fewer difficulties with these mothers than with some others. The word duty I avoid as much as possible, but I do try to make them feel that maternal feeding is as much a part of motherhood as is pregnancy, and, as such, must be gone through with. Nature will provide for the unborn child, but upon the mother rests the post-natal care and responsibilities.

The age of the mother does not seem to make any material difference as to lactation, even with a primipara at 40. One mother giving birth to her first baby at 42 had an abundance of breast milk. Two others, 39 and 40 respectively, each having lost 2 babies at birth, are now nursing their third infants with milk to spare.

After observing a number of babies closely the first month or 2, I have come to the conclusion that it is better to be satisfied with a small gain at the breast rather than to begin additional food too early. Sometimes an infant whose weight may remain almost stationary 3, 4 and even up to 6 weeks, taking 15 to 18 ounces of milk in 24 hours, will, a little later, gain 25 or 30 grams a day on practically the same amount of food. These mothers, then, realizing that it was the baby rather than the food that was at fault, become our best distributors of breast feeding propaganda, while if artificial food had been added, the breast feeding would have become secondary and the baby weaned sooner than otherwise.

Maternal feeding need not be a burden to the young mother, and after lactation has become established, it is not necessary for the mother to be always at hand when the clock strikes the hour. By teaching her expressing, the mother may empty her breasts and save the milk, if social or other engagements interfere with the feeding hour. For an evening affair, the 6 to 10 period may be lengthened to 11 or 12, or whenever the mother comes home, as often times a baby will sleep past the last hour of the day.

When a mother has learned to appreciate the value of breast milk she hesitates to wean the baby entirely and I have known several instances of the mothers keeping the early morning breast feeding for several weeks after the baby has supposedly been



weaned, to ward off "teething" and "second summer" ills, knowing that the breast milk can be brought back if necessary.

Of the babies so supervised, approximately 44 per cent. are past their first birthday and they have been remarkably well and free from intestinal disturbances, and there has been only one death (erysipelas following adenitis and suppurating otitis media.)

I have 9 nieces and nephews ranging from one to 14 years of age; these children were all breast fed from 9 to 10 months. Complemental food was given in one instance from birth (child delivered by Caesarian section), and in another, at 3 months. In all cases cereals and vegetables were usually added at 6 or 7 months. These children have been very well and until of school age rarely needed medical attention. After entering school, measles and pertussis were encountered. There being no complications, they have so far made good recoveries.

Every mother is anxious for her baby's welfare and she can easily be made to see that what nature has provided is by far best for its normal growth and development, and even though her supply of breast milk may be insufficient, "half a loaf is better than none."

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LEUKOLYSINS IN CHILDREN'S DISEASES (Pediatria, Naples, Dec. 1, 1920). G. Jemma's research confirms the statements of Maggiore and Sindoni in 1917 and 1918 in regard to the presence in blood of children with internal leishmaniasis, malaria, etc., of substances that have a destructive action on the leukocytes, especially on the polymorphonuclears. Jemma gives the details of three cases of leishmaniasis, three of typhoid, eleven of inherited syphilis and four with tuberculosis. These leukolytic substances were never found in the tuberculous nor in inherited syphilis without leukopenia; they were present in all the others tested but disappeared under effectual treatment, and returned as the effect of the treatment wore off. These and other facts suggest that these leukolysins are the direct products of the causal agents of the disease, and are an important factor in the pathogenesis of infectious diseases, especially from the standpoint of the defensive reactions.—*Journal A. M. A.*

# ROËNTGEN THERAPY IN INTRATHORACIC LESIONS WITH SPECIAL REFERENCE TO STATUS THYMUS LYMPHATICUS.\*

BY WM. H. MEYER, M.D.

Director of X-ray Department, New York Post-Graduate Medical School and Hospital.

*Introduction.*—I have the temerity of appearing before you, not because of any new theory, as regards the effect of roëntgen rays on normal or pathological tissue, but because of results obtained when employing a comparative absorption measure as dose standard. Since x-ray therapy is being more generally prescribed, it is time for a more general, clearer conception of the factors involved.

*Basis.*—As suitable foundation for my subject and still of reasonably demonstrable interest to you, I have selected 100 consecutive cases of intrathoracic lesions, limited to those proven by roëntgenogram, in which the clinical diagnoses were as follows:

Enlarged or persistent thymus and status thymico-lymphaticus . . . . .	50 cases
Hodgkin's disease . . . . .	34 cases
Mediastinal adenopathy—Tuberculosis (3) and tumors of unknown origin (12) . . . . .	15 cases
Mediastinal sarcoma? . . . . .	1 case

In the group of thymus cases (as occurs in every clinic), we have lost track of 8 cases.

There have died of intercurrent disease (bronchopneumonia) 2 cases.

Of the remaining 40 cases, clinical improvement was noted in practically every instance.

Roëntgen evidence of retrogression has in many cases been obtained, a few plates of which I will present later.

In Hodgkin's disease, and other mediastinal adenopathy, primary retrogression of the lymphomata, following radiation, is without exception the rule. We have succeeded in keeping some of these patients alive and comfortable for

\* Read before the Section on Pediatrics, New York Academy of Medicine, April 14, 1921.

periods of from 3 to 6 years. However, as far as this series of cases is concerned, the recent influenza epidemic played havoc with our Hodgkin's cases, thereby revealing the very low resistance of this type of case to acute infections.

Furthermore, the roëntgen rays can hardly be blamed for a high mortality since the true etiological factor is still a mooted question. Of the 34 cases noted, there are 14 remaining alive today, and doing well.

What has been said in reference to Hodgkin's disease also holds true in mediastinal tumors of unknown origin. On the other hand, in tubercular mediastinitis, the results appear as uniformly good as with cervical adenitis. The treatments, however, must extend over a considerable period. Of the 16 cases mentioned, 8 are alive and well to date.

The astonishing fact concerning the single case of mediastinal adenosarcoma is that after almost complete disappearance of the mass, a second section of a supra-clavicular node was pronounced by the pathologists as probably Hodgkin's disease, with very marked fibrosis.

Be this as it may, I will show you in several successive exposures, the retrogression of the mass during and following radiation.

In many of these cases, there were other expressions of lymphoid hyperplasia, such as adenoids and hypertrophied tonsils; cervical, axillary and inguinal glands; enlarged spleen, etc., each of these showed retrogression under proper radio-therapeutic procedure.

The development, anatomy, histology, physiology, pathology, symptoms, diagnosis, and differential diagnosis are not a part of my subject this evening, yet I wish to thank the department of pediatrics at the Post-Graduate for their coöperation and assistance in our end of the work, and Dr. Appel, who has permitted me to read the preliminary sheets of an article soon to be published, summarizing much of the authoritative work along these lines.

*Historical.*—Animal experiment conducted by Heineke,<sup>1, 2</sup> in 1903, showed a profound effect on lymphoid cells and structure. His dosage, however, appears to have been extreme, and the results were destruction and disappearance of lym-

phocytes, with retrogression, absorption and shrinkage of lymphoid tissue generally.

More extensive experiments by Rudberg<sup>3</sup> in 1907, with more reasonable, both single, large and divided dosage, showed similar but less pronounced glandular retrogression and destruction. It is also worthy of note that the epithelial lining of the stroma offers greater resistance to radiation, and therefore a more pronounced tendency to regeneration.

Regaud and Cremieu,<sup>4</sup> in 1911, note that with repeated dosage, with no single dose sufficient to produce total destruction, a permanent atrophy of lymphoid structure could be produced.

Eggers,<sup>5</sup> in 1913, reports that with dosage sufficient to cause only a primary retrogression, early regeneration may occur. These effects were noted on all lymphoid structures, including the thymus, spleen, lymph glands, as well as bone marrow and white blood cells. These then may be included as structures of definite radio-sensibility.

A careful review of these authors, as well as many subsequent studies and numerous case reports, brings one to the realization that destruction, inhibition or stimulation is a matter of dosage. However, it is evident that dosage to animals is not directly transferable to humans, and still further that there is today unfortunately no universally satisfactory dose standard.<sup>6</sup>

In many animal experiments which I have personally conducted as early as 1903, with the gas tube, and again, in 1914,<sup>7</sup> with the Coolidge tube, I have proven to my own satisfaction that under varying conditions, certain animal skins could stand much greater dosage than that of the humans. Furthermore, the size and depth of animal structures is far different from that of the human. Nevertheless, from many authoritative case reports, as well as those in our own hands<sup>8</sup> there is no doubt that with sufficient dosage, similar effects can be produced in the human.

In the foregoing, I have confined my remarks to the direct effect of radiation, of which we have substantial proof, purposely avoiding theory as to electronic disturbance, physico-chemical change, and the formation of enzymes and antibodies, of which we have but little practical knowledge.

With our method of dose calculation, I feel *first*, that retrogression, for example of the thymus, with clinical cessation of symptoms is obtainable within a period of from 1 to 4 months; *secondly*, that, providing dosage be exact, failure of symptomatic relief suggests an error in diagnosis; *thirdly*, that the effect of properly measured roëntgen dosage on the thymus appears so definite that it might be applied as a diagnostic procedure in doubtful cases.

A schematic chart of our method of determining dosage and reaction is as follows:

EFFECT OF RADIATION ON RADIOSENSITIVE STRUCTURES.

Action	Stimulative		Inhibitive		Destructive
	Mild	Strong	Passing	Prolonged	Total
Cumulative	10	25	50	100	200
Absorp. Per	To	To	To	To	To
CM. Depth	20	35	60	120	250
Biological Effect	Increased Metabolism		Anabolic		Catabolic
Reaction	Repetition of dosage necessary to continue effect. Full recovery to normal activity in from 1 to 3 months.		Possible Recovery in from 1 to 3 years.		Necrosis slow to heal with scar tissue formation

Cumulative absorption is determined by absorption rate Note (1) multiplied by the number of standard incident surface doses to a given area Note (2), multiplied by the number of portals of entry.

Note 1. The difference between transmitted intensity at any given depth and the incidence 1 cm. above this is used to indicate the absorption rate.

Note 2. The standard radiometric reading, supposedly representing the erythema reaction is used as the measure of incident dosage, but by no means as an erythema reaction.

*Dosage.*—Since with the x-rays, we are dealing with an energy which is variable in penetrability, incident or surface intensity can not be a guide to even skin reaction, let alone biological effect.

Experimentally, it has repeatedly been shown that with



FIG. 1, A.

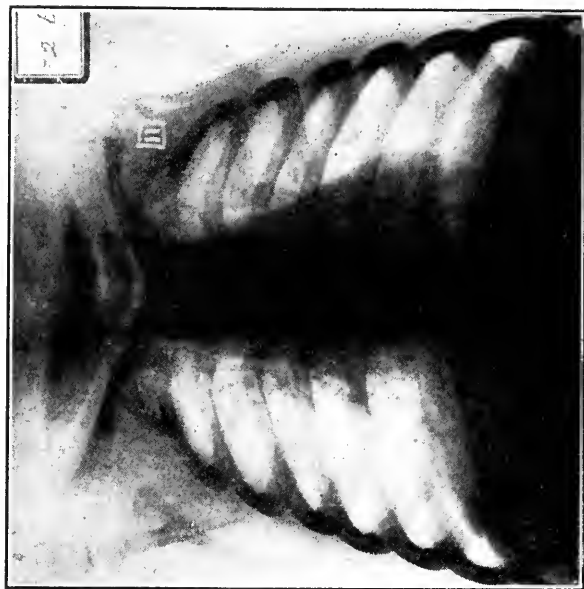


FIG. 1, B.

CASE 1.—Name, J. S. Age of child at the beginning of treatment was 4 months. Referred by Pediatric Clinic. Clinical diagnosis was enlarged thymus. The thymic shrinkage along with normal thoracic development is noted in comparing cuts A and B.

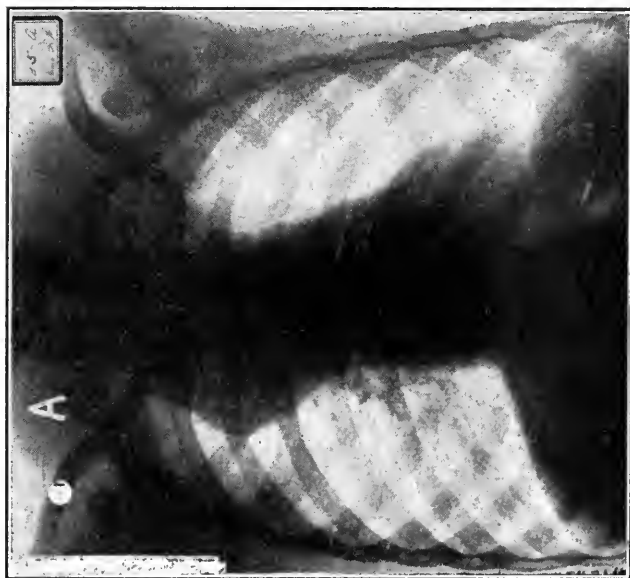


FIG. 2, A.

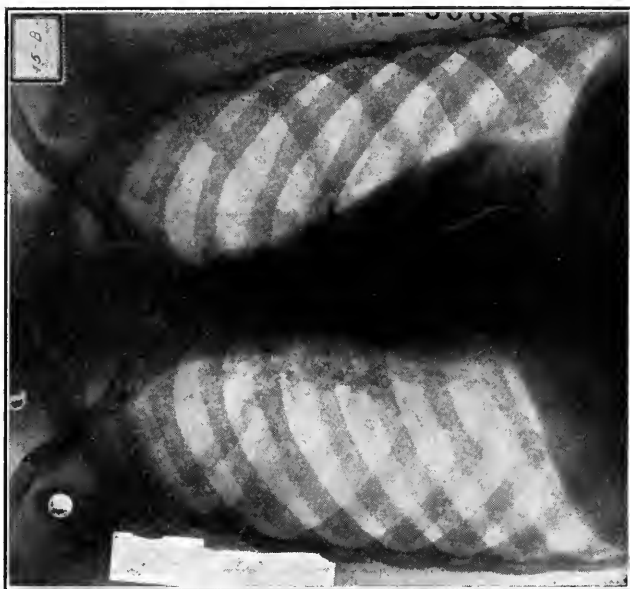


FIG. 2, B.

CASE 2.—Name, I. W., Age 13 years. Referred through Women's Medical Ward (Prof. Chace). Clinical diagnosis—Hodgkin's disease. In comparing the cuts, the effect of radiant energy on lymphoid structures is well illustrated. The elapsed time between A and B is 3 months.

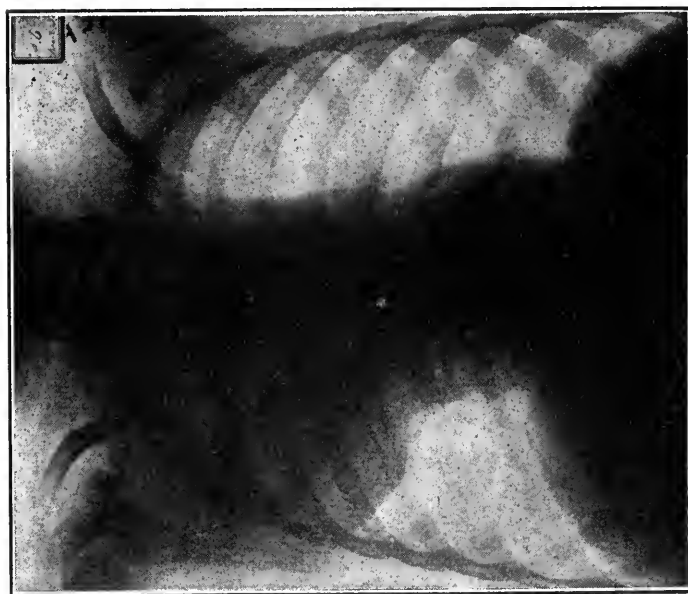


FIG. 3, A.

CASE 3.—Name, I. B. Age 8 years. Referred through the Male Medical Ward (Profs. Chace and Peterson). Clinical diagnosis—mediastinal tumor. The course of this case is well shown by the consecutive prints A, B, C and D. The elapsed time between A and B is one month and between B and C two months. C and D have not been included in the illustrations, since C shows but slight retrogression over B and D is practically a normal appearing chest.

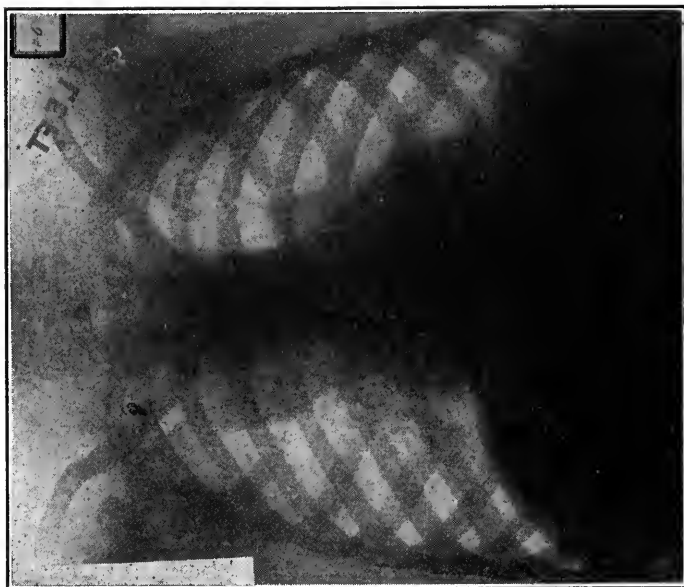


FIG. 3, B.



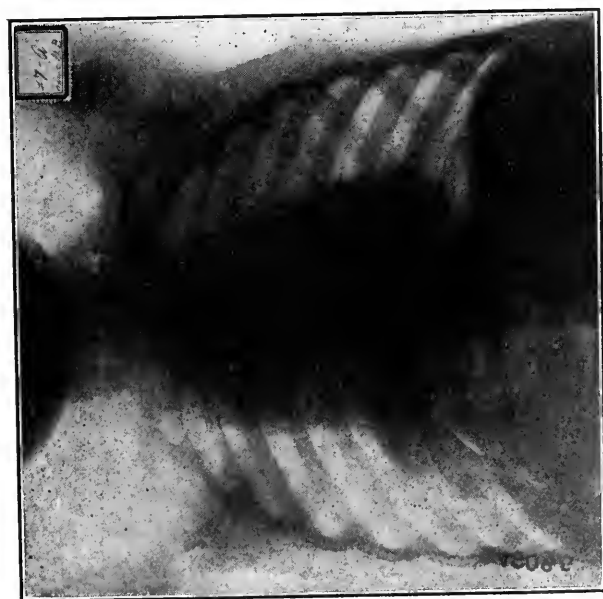


FIG. 4, A.

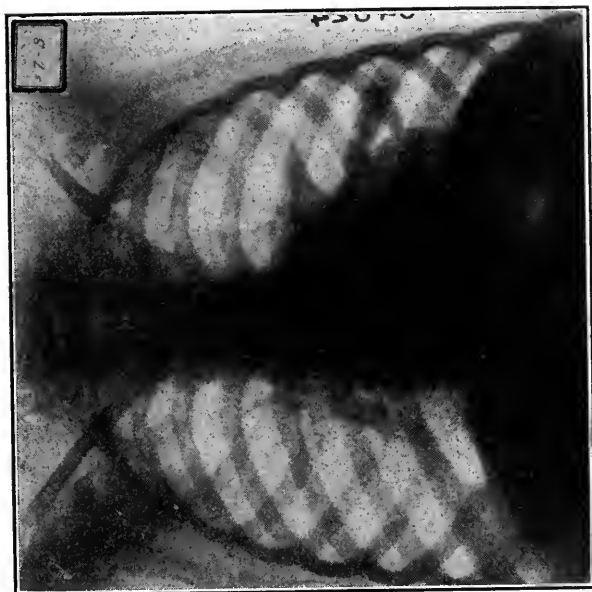


FIG. 4, B.

CASE 4.—Name, G. B. Age 5 years. Referred through the Babies' Wards by Prof. Caillé. Clinical diagnosis—sarcoma. The elapsed time between cuts A and B is 4 months. Retrogression of the mass is again quite evident. My regret is that the pathologists changed the diagnosis from sarcoma to Hodgkin's disease, with pronounced fibrosis, after treatment had been instituted.

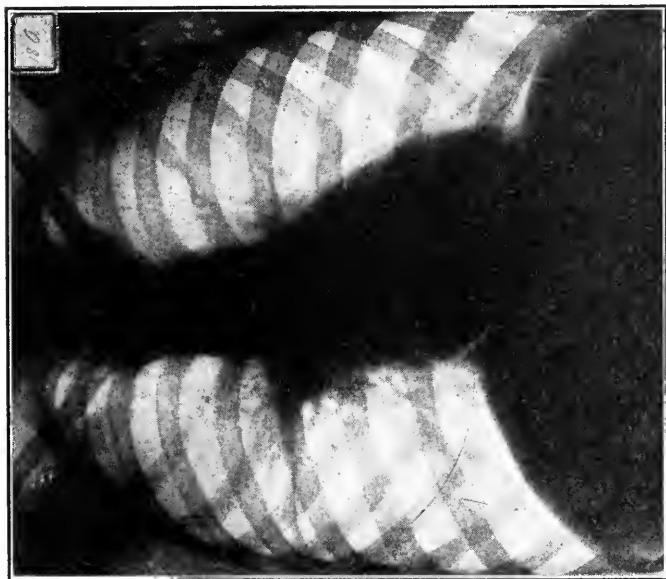


FIG. 5, A.

CASE 5.—Name, A. G. Age 14 years. Referred by Medical Clinic. Clinical diagnosis—hilus tuberculosis. The elapsed time between cuts A and B is 6 months. Retrogression of the triangular shaped area of infiltration seen projecting from the hilus in cut A is conspicuous by its absence in cut B. If one considers the pronounced retrogression of tubercular cervical glands, then this and similar cases will not seem extraordinary. In the cases of tubercular adenitis, frequently repeated or divided dosage, stimulative in character, appears most desirable, whereas if thymic or lymphoid retrogression is wanted, inhibitive dosage is undoubtedly indicated. On the other hand, in suspected malignancy, powerful inhibition, if not destruction, should be the aim. It is in illustration of these facts that the above cases have been selected for illustration.

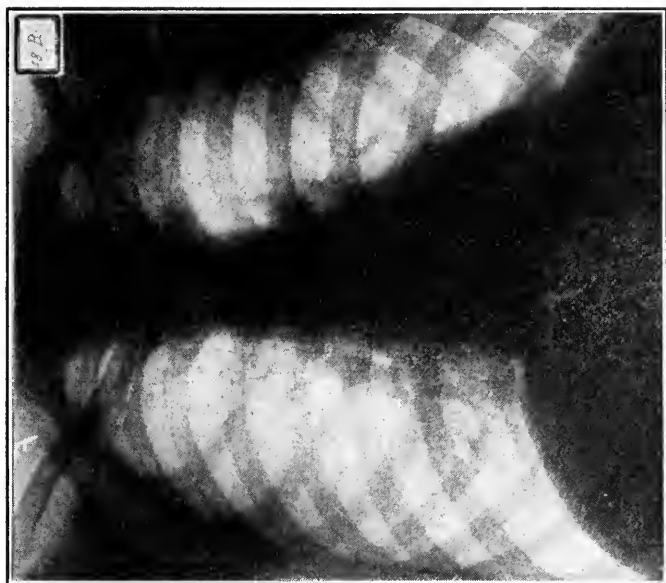


FIG. 5, B.

variations in penetration and filtration from  $\frac{3}{4}$  to 3 times a given measured incident dose may be applied ere a noticeable skin reaction is obtained.

It therefore follows that since a measured incident dose is not indicative of either skin or biological reaction, then neither can the measured transmitted rate be indicative of deeper reaction.

I wish to lay stress on this point, because of recent developments on the Continent, where extremes in penetration and filtration are being exploited. The improved dosage is indicated by improved transmission rate. This is unquestionably true, but with the reduction of the number of portals of entry, I question very much whether their results are any better than ours. As a matter of fact, no matter what the technique, biological reaction is undoubtedly dependent on absorption, and not on surface intensity, nor even on the transmission rate.

I question whether anyone will contradict that measured absorption is the ideal method of dose estimation. Quoting from a former article, "work done requires the expenditure of energy, which energy must be consumed or transformed at the proper site," otherwise it is energy wasted.

Unfortunately, no universally adaptable instruments for measuring absorption have been devised. On the other hand, very few seem to have thought of the possibility of employing our present instruments for this purpose, namely, subtract the measured transmitted intensity through a given small thickness of substance from the measured incident intensity, and the energy transformed and consumed will be indicated. Notwithstanding, first, the effect of a small percentage of secondary rays; secondly, the faults of present day measuring devices, and third the personal equation, it is remarkable how closely this method of dose estimation will indicate the skin reaction, irrespective of penetration or filtration.

It is therefore reasonable to assume that this should also prove the method of deep dose estimation, and many experiments as well as the results obtained, justify the assumption. I do not offer this method as original or complete, and realize fully its shortcomings. On the other hand, criticism, even

from a physicist, that is not constructive, is useless. As soon as something better is offered, I shall be only too glad to accept it, but as matters now stand, so far as I know, we appear to be the only ones in this country employing and teaching such a method of dose estimation.

A summary of satisfactory roentgentherapy implies:

1. A correct diagnosis so that a sarcoma or other malignancy will *not* receive a stimulative dose, or that conversely, an inhibitive action be brought to bear when stimulation is desired.

2. The selection of penetration and filtration should be such that the best possible absorption rate be brought to bear at the site of the lesion.

3. The adjustment of M. A. and distance, so that the treatment be not excessively long, yet with due regard to the life of the tube and safety of the patient.

4. The time factor, under the above conditions, is limited so that no given skin area be unduly injured. On the other hand, in extreme and urgent cases, it may at times be justifiable to exceed this dose when a sufficient number of portals of entry can not be found.

5. The size of each area should be sufficiently large to include the whole of the local lesion, yet with maximum protection of the uninvolved tissues.

6. The number of areas for cross-fire should be determined by (a) the size and extent of the lesion; (b) the average mean depth of the lesion (including the size of the patient); (c) the radiosensibility of the structures involved, and (d) the reaction desired (this determined by the total cumulative absorption).

7. Finally, the period within which this dose is brought to bear.

From what I can gather from many authors, but mainly from some 16 years' personal experience, it appears that if even a passing inhibitive action is desired, it must be achieved within a period of from 1 to 2 weeks. Otherwise, stimulation may result. To continue this reaction requires a repetition of the same dose at not less than monthly intervals. And even-

tually either by cumulation or sustained tissue reaction of both, regeneration may be indefinitely deferred.

A more powerful inhibitive reaction (i. e., prolonged inhibition) brought to bear within a period of from 1 to 2 weeks causes more pronounced retrogression, and may be permanent or hold regeneration in abeyance for a period of from 1 to 3 years.

A destructive dose of course requires no repetition.

On the other hand, stimulation may require frequent repetition for sustained action.

*Conclusion.*—The milliamperemeter and spark gap or equivalents, the filter thickness, distance and laws governing the same, all are essential accessories to our armamentarium. However, none of these, nor even so many pastille or skin unit doses, give a clue to the true biological reaction. For this we must turn to absorption for answer.

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PURPURA IN INFANTS (Paris Médical, Dec. 4, 1920). Nobécourt and Mathieu encountered five cases of purpura in a recent series of 938 infants at the maternity. The most frequent cause is inherited syphilis, next in order is pneumococcus or meningococcus septicemia, but in a number of cases it is impossible to detect the cause. These are the fulminating, the acute forms, with negative bacteriologic findings. They never found syphilis responsible for purpura in older infants, and older infants do not present the hemorrhages in mucous membranes and viscera which are common in purpura of the newly born. Specific treatment and specific serotherapy must be early and intensive. Antipneumococcus serum, which has given fine results in treatment of pneumonia and pleurisy in infants, might prove useful in pneumococcus purpura.

—*Journal A. M. A.*

## GOAT'S MILK.

BY JOSEPH K. CALVIN, S.B., M.D.

Chicago.

Considerable interest has been aroused recently, especially among the laity, with regard to the employment of goat's milk as a food for man. Newspapers and popular magazines have contained articles upon this subject, but practically nothing has appeared in current medical publications. The purpose of this article is to summarize briefly the actual scientific data about goat's milk.

From early historic times, goat's milk has been utilized by humans. Today it is very popular in certain European countries, especially in Italy, Switzerland, France and Germany. It is even preferred to cow's milk in Italy. In this country we are accustomed only to cow's milk and so know little of the merits of goat's milk. In fact, the goat has always been an animal of more or less ridicule here. Spargo<sup>1</sup> states that all things considered, the neglect of the goat as a milk animal, especially as a provider of food for infants, is very much to be deplored. Rosenau<sup>2</sup> states that the animal seems to be altogether well fitted to be the wet nurse of the human infant, much more so than the cow, and it is a great pity that ignorance concerning its habits and qualities should stand in the way of its more general employment. The goat is especially useful to those who desire a small quantity of milk and do not have the room or cannot afford to keep a cow, and great benefit is thus derived from having fresh milk at hand at a low cost.

The characteristics and composition of different animal milks varies according to the food requirements of the species of animal it is to feed. However, the milks of different mammals contain practically the same constituents but vary in the proportions of these constituents.

*Characteristics.*—Goat's milk is pure white, without especially pronounced odor or taste. There may be a peculiar "goaty" taste and unpleasant odor in the milk but this can be entirely avoided if the goat's milk is properly produced and handled, i.e. by preventing manurial pollution, by keeping male goats out of and

away from the stable in which the milking is done, and taking precautions to keep the udder clean and the hair and dirt out of the milk, thus preventing the odoriferous acid skin secretions from contaminating the milk.<sup>3</sup> Anderegg<sup>4</sup> states that those easiest to keep clean are the short haired, single color, hornless variety. The bucks have a very strong odor.

*Composition.*—According to Heinemann<sup>5</sup> the average specific gravity is 1.0305. It has a higher degree of viscosity than cow's milk, and the average composition is as follows:

Water .....	86.88
Casein .....	2.87
Albumen .....	0.89
Total Protein .....	3.76
Fat .....	4.07
Sugar .....	4.64
Ash .....	0.85
Total Solids .....	13.12

Van Slyke<sup>6</sup> gives the following comparisons of goat, human, and cow's milk:

	Goat	Human	Cow
Fat .....	3.80	3.30	3.90
Milk Sugar .....	4.50	6.50	4.90
Protein .....	3.10	1.50	3.20
Salts .....	0.939	0.313	0.910

The analysis of the casein in goat's milk follows:<sup>7</sup>

	C	H	S	P	N	O
Goat ...	52.90	6.86	0.700	0.760	15.48	23.300
Cow ....	52.69	6.81	0.832	0.877	15.65	23.141

Combining power equivalents of the casein:<sup>8</sup>

	Equivalent.
Goat .....	1190
Cow .....	1124-1135
Human .....	1200-1428

There is no essential chemical difference between the constitution of goat's milk casein and that of cow's milk.<sup>9</sup>

The casein coagulum forms a more compact firm mass than does the bovine.

In general the chemical composition of goat's milk is similar to cow's milk, sufficiently similar at least, to permit of its being

So.  
Pot  
Sodiu  
Calcium  
Bosw  
Goat's milk

modified in the same way as bovine milk for infant feeding.<sup>10</sup> The protein is considerably higher than in human milk, the sugar considerably less. The fat varies from 2.5 to 7.5 per cent.,<sup>11</sup> generally a little greater than in cow's milk. The butter fat is white, there being an entire absence of pigment.<sup>12</sup> The fat rather closely resembles the fat in human milk. The fat globules are relatively small, and in very fine droplets,<sup>13</sup> and of uniform size. They rise slowly and in most cases no cream layer is formed. The cream cannot be separated by centrifuging<sup>14</sup> but may be thoroughly separated in a cream separator. Goat's milk fat is richer in insoluble volatile acids than cow's milk fat but on the whole there is very little difference in comparing the chemical composition of the two fats.<sup>15</sup>

In regard to the salt content, goat's milk differs from cow's,<sup>16</sup> (1) in containing tricalcium phosphate, di- and tri-magnesium phosphate, monopotassium phosphate, (2) no monomagnesium or dipotassium phosphate. Human milk contains no insoluble phosphates, goat's and cow's milk contain more phosphorus than human milk. There are more chlorides in goat's than in human and cow's milk, and sodium and potassium chlorides are present in the former but not in the latter. The number of different salts appears to be greatest in goat's and least in human milk. McLean claims that goat's milk contains more iron than cow's milk.<sup>17</sup>

## SALTS.

	Cow's Milk	Goat's Milk	Human Milk
	%	%	%
Di-calcium phosphate . . . .	0.175	0.092	0.000
Tri-calcium phosphate . . . .	0.000	0.062	0.000
Mono-magnesium phosphate	0.103	0.00	0.027
Di-magnesium phosphate . . .	0.000	0.068	0.000
Tri-magnesium phosphate . .	0.000	0.024	0.000
Monopotassium phosphate . .	0.000	0.073	0.069
Dipotassium phosphate . . .	0.230	0.000	0.000
Sodium citrate . . . . .	0.052	0.250	0.103
Calcium citrate . . . . .	0.222	0.000	0.055
Sodium chloride . . . . .	0.000	0.160	0.000
Potassium chloride . . . . .	0.000	0.095	0.000
Iron . . . . .	0.119	0.115	0.059

Slyke<sup>18</sup> state that the soluble compounds of iron are separated from the suspended or colloidal com-



ponents by filtering through a Pasteur-Chamberland filter. The serum is nearly transparent and has a faint greenish-yellow tinge, with a slight opalescence. In true solution are sugar, the salts of potassium, sodium and chlorine. Partly in solution are albumen, inorganic phosphorous, calcium and magnesium compounds and citrates. Entirely in suspension or in colloidal solution are fat and casein. The insoluble portion of goat's milk, when freshly prepared and moist, is grayish to greenish white, glistening and gelatinous. Shaken with water this insoluble part is suspended and the mixture assumes the appearance of milk. The suspension is neutral to phenolphthalein. The insoluble portion consists of calcium caseinate, di- and tricalcium phosphate and magnesium phosphate.

*Yield.*—The goat is called the “poor man's cow” because goat's milk is cheaper than cow's milk. The goat produces about twice as much milk in proportion to her body weight as the cow. The goat may yield 10 to 12, or even 15, times its body weight in milk per year, while a cow yields but 5 or 6 times its weight.<sup>19</sup> By good feeding, 800 kg. or more (600 to 1,100 liters) of milk may be obtained in a year. A year old goat will produce 300 to 700 liters a year.<sup>20</sup> The goats usually provide milk about 6 months out of a year and a lactation period ranging from 7 to 10 months is considered very satisfactory. However, many of the pure bred Toggenburgs provide milk 10 to 11 months out of the year. They produce most milk immediately after lactation begins; after 3 months the output begins to fall. Most milk is usually produced during the summer (June-August).<sup>21</sup> A good scrub or common goat will yield about 2 quarts of milk a day,<sup>22</sup> and the production of 3 quarts is considered excellent. However, a good grade Toggenburg will produce from 3 to 4 quarts and some pure bred Toggenburgs will run from 5 to 7 quarts per day.

Goats are cheap because they can be kept at small cost. Although they eat more than cows do in proportion to their size, yet they are satisfied with much cheaper food. It is generally estimated that from 6 to 8 goats can be kept upon the feed required for one cow.<sup>23</sup> A goat can be kept on a small plot of grass, whereas a cow requires a much larger pasture.

Milk goats are very prolific. The usual number of kids is 2 at a time, although it is not rare to produce 4.

Goats are very hardy animals, and many breeds are suitable milk producers in all climates.<sup>24</sup>

Thus a goat will supply sufficient milk for the average family and can be kept where it would be impossible to keep a cow, which fact should appeal especially to people living in small towns and the suburbs of large cities.

Practically all publications dealing with milk goats attribute considerable importance to the use of the milk for infants and invalids.

A considerable number of cases in which goat's milk has proven especially valuable for infants and invalids are on record. In many of these cases other foods had been tried and did not seem to agree with the patients. The following is taken from Bulletin 429 of the New York Agricultural Experimental Station under the heading "Summary":<sup>25</sup> Extensive study of the use of goat's milk in infant feeding by Drs. Sherman and Lohnes, of Buffalo, showed that the curds of goat's milk, when returned from the stomach, were smaller and more flocculent than those of cow's milk. From the determination of the combined hydrochloric acid in the returned food, the authors conclude that the cow's milk had a greater stimulating effect on the stomach than goat's milk. The absorption of the food and gain in weight in comparing the two milks were indefinite for several reasons. The babies tolerated equally well similar amounts of goat's milk with cow's milk when used with the same diluents. The younger the child the more the evidence pointed toward a greater gain on goat's milk.

Goat's milk was supplied to 18 cases of children that were not thriving on any other food that had been tried. In 17 cases, a satisfactory state of nutrition was established through the use of goat's milk, the beneficial results in some instances being very marked. With certain of these children their situation was regarded as serious, and their restoration to a satisfactory nutritional condition was good evidence that goat's milk is often a very desirable resort for infant feeding. Griffith<sup>26</sup> states that in infant feeding goat's milk may sometimes be advantageously employed when that of the cow is not obtainable.

In a project carried on coöperatively by the Sea View Hospital, New York, and the Bureau of Animal Industry, the value of

goat's milk for tuberculous patients was investigated. The cases treated were all pulmonary tuberculosis varying from quiescent, with slight infiltration, to active, far-advanced cases with extensive infiltration and cavitation. Adolescents were preferably chosen, irrespective of sex, and in order to have as many as possible under treatment at the same time, some were accepted as low as 6 years of age. The results showed that the goat's milk cases and the controls progressed about the same and both gained about the same weight. These results are therefore entirely negative.<sup>27</sup>

Goat's milk can be utilized for the same purposes as cow's milk, i.e. for drinking, cooking, in cakes, tea and coffee, to which it is said to give a rich flavor, and large quantities of goat's milk cheese are manufactured in Europe. It is not very satisfactory for making butter.

Cautley<sup>28</sup> states that the main advantage of goat's milk is that with a small plot of grass one can keep a goat, feed it carefully and obtain fresh, pure milk. Pfaundler and Schlossmann's text<sup>29</sup> states that because many people can afford to keep a goat, that if goat's milk is aseptically obtained it is the most suitable substitute for breast milk, since it has not been exposed to the possibility of changes, has not lost its natural properties and can be given raw. Thus the deterioration entailed in dealing with the milk and transporting it is diminished. In fact, in many localities where it is easy to keep a goat, fresh cow's milk is difficult to obtain. A goat can be kept where it is impossible to keep a cow and it will consume considerable feed that otherwise would be wasted. In England and in many other parts of Europe, people who leave the cities during the summer months either for their country homes or for travel, often take a milk goat with them so that the infant may have a good supply of fresh milk of uniform quality. No other animal is so well adapted for such a purpose, and there is probably no other country where goats are so much needed for such a purpose as in the United States.<sup>30</sup>

Babies can take the milk directly from the udder. It is customary in many parts of France and Switzerland to carefully wash the udder and teats and permit the infant to suckle directly<sup>31</sup> which certainly insures fresh, clean milk. The goat has proven a splendid foster mother for infants, calves, lambs, colts and pigs.

The goat is a very clean animal and the dry condition of the normal stool makes it easily possible to keep the udder clean.<sup>32</sup> Because of the solid feces there is much less danger of contamination of the milk.<sup>33</sup> Goats acquire enteritis much less frequently than cows. The cow easily develops a diarrhea with accompanying danger of infecting the milk with virulent bacteria.<sup>34</sup>

Another advantage of goat's milk is that it cannot be skimmed as the cream does not form a distinct layer.<sup>35</sup> Consequently, dishonest dealing along this line is obviated.

Goats are practically immune to tuberculosis.<sup>36</sup> Only 0.4 to 0.6 per cent. of the goats in Prussia gave a positive reaction for tuberculosis.<sup>37</sup> The question of the transmission of a passive immunity to tuberculosis by the transfer of natural antibodies from goat's milk to very young infants or from the use of this milk over a much longer period is a subject of investigation, at present incomplete.

It might appear from some very limited data that goat's milk is considerably higher in antiscorbutic properties than cow's milk. Moore states that 6 guinea pigs weighing from 110 to 145 gm. each were fed on fresh goat's milk, one set for 80 days, a second for 44 days. The animals developed normally with no clinical symptoms of scurvy although similar experiments with cow's milk resulted in scurvy.<sup>38</sup>

From the foregoing facts, it is evident that goat's milk deserves more consideration than it is at present receiving in this country. Under certain circumstances it appears to be a valuable artificial food for infants. More experimental work to determine its exact status in the feeding of normal and sick infants should be carried out, so as to place it on a sound scientific basis. The milk-goat industry is only in its infancy in America. The widespread use of goat's milk will sooner or later be a fact in this country because of the milk's many practical advantages in special instances.

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- 5 So. Wabash Ave.

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TYPHOID IN INFANTS (Archivos Latino-Amer. de Pediatria, Nov.-Dcc. 1920). In the first of Vallino's two cases the symptoms were those of meningeal disturbance for 5 weeks, and although the lumbar puncture fluid was clear, anti-meningococcus serum was injected. Finally the spleen became enlarged and the skin showed spots suggesting typhoid, but the agglutination test was negative. The subsidence of the fever confirmed the suspicion of typhoid, and the agglutination test at last became positive and the child of 18 months recovered. In another child 2 years old the irregular fever was accompanied by enlargement of liver and spleen, and the disease continued for 5 weeks. By exclusion, typhoid was suspected, confirmed by agglutination. Vallino knows of only 2 other cases of typhoid in such young infants that have been published in Argentina.—*Journal A. M. A.*

# X-RAY TREATMENT OF TONSILS AND ADENOIDS IN CHILDREN.\*

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The development of x-ray therapy of tonsils and adenoids and the absolute safety of this method as compared with the incomplete and partial removal of foci of infection of the throat by the surgical removal of tonsils and adenoids, not to mention the possible dangers and complications attending operative procedure, indicate a marked advance in the therapy of rheumatism, endocar-

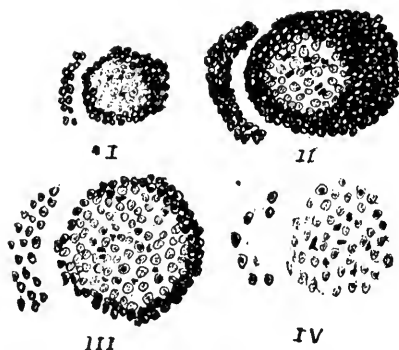


FIG. 1. I. Standard Lymph Follicle. II. Lymphoid Hypertrophy. III. Fibrous Hypertrophy. IV. Effects of X-Ray on Lymph Follicles.

ditis, pericarditis, and all those conditions resulting from the focal infection of the throat.

The underlying principle of the effect of x-ray on lymphatic tissue is well illustrated in Fig. 1. In this it can readily be seen that the lymph follicle has been stimulated to excessive cell proliferation to such an extent that there remains less resistance to the x-ray than to the normal adjacent cells. Also, the selective action of x-ray on embryonic tissue is clearly defined, especially in the fibroid tonsil, in which the follicle consists mainly of cells undergoing mitosis.

The drawings made of the throat in Fig. 2 point out the reduction in size or atrophy of the tonsil after one massive dose of x-ray. This reduction in size is due, as heretofore described, to the destruction or absorption of the immature lymphatic cells in

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the follicle, thus lessening the depth and distortion of the crypt, at the same time causing an eversion and evacuation of the crypt contents.

<sup>11</sup> It is quite evident from the appearance of the throat often seen in follicular tonsillitis that the removal of tonsils and adenoids in cases of rheumatism, endocarditis, etc., only partially eliminates the foci of infection in the throat. Here we have evidence of a general infection of the crypts and follicles, not only of the tonsils but of the entire mucous membrane. In chronically infected

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MARCH 3, 1920.

Right Tonsil, 24 hrs.,	50 Colonies of Hemo. Strep.
Right Tonsil, 48 hrs.,	100 Colonies of Hemo. Strep.
	50 Colonies of Hemo. Staph.
Left Tonsil 24 hrs.,	50 Colonies of Hemo. Strep.
Left Tonsil 48 hrs.,	50 Colonies of Hemo. Strep.
	50 Colonies of Hemo. Staph.
Vault 24 hrs.,	50 Colonies of Hemo. Strep.
Vault 48 hrs.,	50 Colonies of Hemo. Strep.
	150 Colonies of Hemo. Staph.

MARCH 17, 1920—2ND WEEK AFTER X-RAYS.

Right Tonsil, 24 hrs.,	No Colonies of Hemo. Strep.
Right Tonsil, 24 hrs.,	No Colonies of Hemo. Strep.
	No Colonies of Hemo. Staph.
Left Tonsil 24 hrs.,	No Colonies of Hemo. Strep.
Left Tonsil 48 hrs.,	No Colonies of Hemo. Strep.
	No Colonies of Hemo. Staph.
Vault 24 hrs.,	No Colonies of Hemo. Strep.
Vault 48 hrs.,	No Colonies of Hemo. Strep.
	No Colonies of Hemo. Staph.

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Table 1 gives the result obtained in one of the 30 cases in which hemolytic streptococci and staphylococci were eliminated from the crypts 4 weeks after one treatment<sup>1</sup>.

throats the infratonsillar nodule, lingual tonsil, and chain of lymphatics in the lateral walls, extending well up to the eustachian tube, are markedly hypertrophied and contain numerous infected crypts. The operation of dissecting out these individual crypts is necessarily tedious and impractical from the standpoint of complete removal, although some cases of rheumatism have been temporarily relieved and benefitted by this procedure. It is therefore apparent that the x-ray effects on the follicles and crypts of the infratonsillar nodule and lymph follicles throughout the mucous

membrane of the pharynx would be the same as that produced on the tonsilar tissue.<sup>2</sup>

That the x-ray method of treating tonsils and adenoids is not only safe but absolutely harmless has been definitely proven by the large number of cases of tubercular glands of the neck that have been treated by x-ray in the past 10 years throughout the world. These cases require vastly more treatment and a much more extensive area of exposure than in the x-ray treatment of tonsils. A review of the literature on this subject does not reveal the report of any case in which the untoward effects of x-ray on the thyroid, parathyroid, pituitary or parotid gland has been recorded. The exposure for the treatment of tonsils includes only that area extending from just above the external auditory meatus

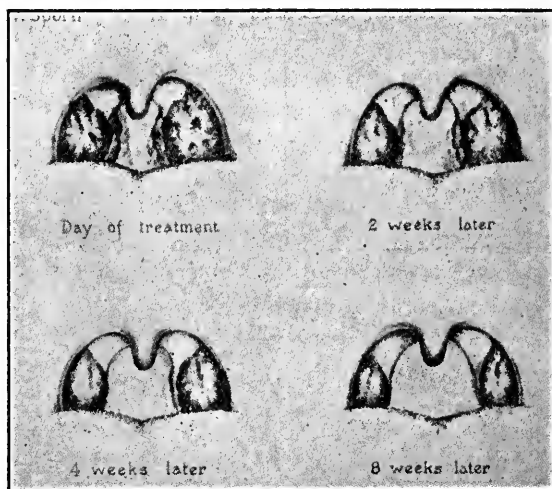


FIG. 2.

down to the level of the hyoid bone, the width of the opening being about  $2\frac{1}{4}$  inches. By adhering rigidly to the boundaries of this area and obtaining the proper angle from the target of the tube to the angle of the jaw, little if any ray will ever reach these glands.

The possibility of an x-ray burn is even more remote than injury to the adjacent glands provided the technique is properly carried out. This is largely due to the perfection and constancy of the present day interrupterless machine and Coolidge tube

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## FEEDING OF INFANTS AND CHILDREN\*

BY JULIUS LEVY, M.D.

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Knowing that the president's address is immune from attack and criticism, I have chosen as my subject one that pediatricians have by a sort of tacit agreement tabooed at their meetings—"The Feeding of Infants and Children." It may be that this has resulted either from their being in entire agreement, or that each has considered his particular method so much a matter of personal preference that the discussion of infant and child feeding has almost become "bad taste," like the discussion of religion. Infant feeding has become classed among personal customs and the dictum has been—"Mores non desputandum est."

But I am prompted to transgress this unwritten law through the knowledge that has come to me in my position of State Consultant in Child Hygiene, of the indifference of many physicians in the state toward the establishment and maintenance of maternal nursing, of ignorance of generally accepted principles of infant feeding, of the indefiniteness of and uncertainty as to the proper time or method of weaning and their entire aloofness to the feeding of children during the pre-school period.

I shall try to present these 4 phases of child nurture and ask your indulgence if, on account of the limited time at my disposal, I present only personal views in a rather dogmatic manner.

Maternal nursing is not merely one method of feeding an infant—it is the only right way. Even if infants thrived as well and did not die in greater numbers in the summer on bottle-feeding, maternal nursing would still be the only right way to feed an infant. And I use the word "right" in the moral sense, if we understand by right—working in the ways of nature, "following in the ways of the Lord."

The milk of the mother has been especially adapted to its young. The milk of each species is different and has been adjusted to its young more particularly in the percentage of proteid it contains and the character of the curd it produces. A study of the milk of different animals and their young brings to light

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many interesting facts that are more than coincidences. The longer the infancy of the species the smaller is the percentage of the proteid and the finer the curd in the milk of the mother.

The lowest percentage of proteid and the finest curd is found in human milk, where the infancy of the young is the longest. Cow's milk has more than twice the percentage of proteid and produces a tough curd. The infancy of the calf is about 3 weeks.

The milk of the dog contains 9.9 proteid and its young reaches puberty in 6 to 8 months. The milk of the cow contains 3.5 proteid and its young reaches puberty in 8 to 12 months. The milk of the mare contains 1.8 proteid and its young reaches puberty in 18 months. The ass' milk contains 2.1 proteid, and its young reaches puberty in 18 months, while the milk of the human contains 1.5 proteid and its young does not reach puberty until 14 years. The curd is directly related to the type of stomach its young develop. In the lower animals the stomach represents from 60 to 80 per cent. of the digestive tract, while in the human it represents but 20 per cent. In the animals, with the large and tough stomach, the curd is hard, tough and gelatinous, while in the human, where there is a small, fine stomach and it represents but 20 per cent. of the digestive tract, the curd is fine and flocculent.

If we limit our comparison to the calf we find that at the end of the third week it is required to digest grass and hay, while the human infant does not subsist on other food than milk till about one year and then only on selected and cooked food. The gastrointestinal tracts must develop differently accordingly and the tough curd of cow's milk serves the very purpose of developing a large multilocular stomach with a strong musculature. Furthermore, cow's milk contains the elements necessary for the development of a calf and no more. The nervous system, and especially the brain, undergoes practically its whole growth and development in three weeks. At that time the calf has acquired all the complex associations of ideas it requires successfully to adjust itself to its environment. Phosphorus and lecithin, important elements in the human nervous system, are not required by the calf and they are absent in cow's milk.

From a biological standpoint it is also clear that cow's milk is no substitute for mother's milk. Immune bodies and enzymes un-

doubtedly are secreted by the breast that add to the infant's resistance and development, but are not secreted by cow's milk. Cows do not have measles and their blood does contain and cannot transmit immune bodies against this disease.

In addition to those chemical, biological and developmental differences in the milks of different species I wish to direct your attention to a relationship that has appealed to me as the most impressive fact in maternal nursing.

It has been pointed out by students of the history of civilization that those species, those peoples or races and indeed even those families, have advanced furthest in the scale of civilization whose young have had the longest infancy. Infancy in this sense means dependentness—a period when through close and intimate contact with the parent the young have a chance to acquire all the adjustments to environment that have enabled the species to survive, to conquer, to develop. The young are then able to go out into the world and adjust themselves more easily to their environment, to acquire new associations and reactions and build up a new civilization.

Maternal nursing to my mind insures this dependentness and compels this intimate parental contact during the important first year. In certain animals, like the simia rhesus, the ant-eater, and especially the kangaroo, whose social proclivities are well known, nature seems to have safeguarded the young by attaching them at birth to the nipple of the mother.

How often have we wished nature had done as much for the babies of some selfish, self-centered, pleasure-seeking or public-spirited women! The frequent intimate contact required by maternal nursing develops mother and infant. Neither the infant nor the fetus is a parasite, as some women and advanced sociologists seem to think. It is true it takes nourishment from the mother but it gives in return a development of the body, of the mind and of the character of the mother that easily compensates for any fatigue, labor or discomfort. Pregnancy and motherhood is a symbiosis, not a state of parasitism. A better appreciation of the place maternal nursing occupies in the development of the individual and the race may give doctors a greater reverence for nature's methods.

Successful maternal nursing depends largely on faith—faith of the doctor in the ability of all mothers to nurse, faith of the

mother in her ability to nurse. It is influenced by a proper régime and nursing technique. Regular three hour intervals during the day and a four hour interval at night permit digestion of the milk, a vigorous appetite, complete emptying of the breasts, and sufficient time for the mother to attend to her duties, a few simple pleasures and to obtain rest.

The diet is of secondary importance. It should be simple, rational and not excessive. Every mother should attempt to nurse her infant and a doctor should never decide that a woman cannot nurse successfully without making a thorough trial for at least 3 weeks, and a consultation may be as important as in appendicitis.

There are no contra-indications per se to maternal nursing. No matter what sickness or conditions the mother may be suffering from, the only real test is the effect on mother and infant. Even tuberculosis in the mother should only be considered a contra-indication if nursing injures the mother or there is obvious danger of infection and then only if the baby is removed from the mother; if the baby is to remain in the mother's care she may as well nurse, as the chance of infection is just as great if it nurses or not, while if it is weaned the baby is deprived of the resistance and immunity that may come from breast feeding.

As more babies become breast fed, which will surely occur as soon as doctors understand that cow's milk cannot replace and should not be substituted for mother's milk, a proper method of weaning infants without discomfort to mother or baby must be more generally applied.

Weaning should be a gradual process during which time the baby is transferred first from mother's milk to cow's milk. It is often found easier to transfer to soft food, but if the baby is not transferred first to cow's milk it is often difficult to get the baby to take sufficient milk.

Generally, babies should be weaned between 9 and 12 months, as it is frequently found that mother's milk does not supply sufficient salts at this age to meet the requirements of growth. In the colored race this condition is frequently observed at 6 months, and as it varies with different mothers and babies it is important to emphasize that breast fed babies should be carefully watched, weighed and examined from the fifth month on, as well

as during the first months. I have frequently noted that a baby that has been thriving on the breast very suddenly runs down at about 6 months and shows signs of rickets. For this reason we frequently introduce 1 bottle at 3 months which can act as relief bottle to enable the mother to spend an afternoon or evening away from the baby and also will introduce elements that may be lacking in breast milk.

The formula should be weak and the quantity small—one ounce of whole milk with 2 ounces of boiled water, without sugar is sufficient at the beginning. I like to give this formula at the 9 o'clock feeding in the beginning so the mother may observe its effect during the day. Usually there is no need to add any further bottles till the seventh or eighth months, although this will be somewhat determined by the age at which we intend to wean.

There is no absolute age for weaning; while babies should usually be weaned before one year, the intelligence and dependability of the mother, the condition of the infant, its progress and the season must be considered.

I prefer to wean a baby before the summer if I think it cannot be nursed throughout that season for the reason that if the bottle feeding is well established and properly adjusted the baby thrives better than if it is carried through the summer on inadequate breast milk.

Weaning should cover at least a period of one month, and preferably of several months. On the other hand, maternal nursing should be discontinued rapidly after it has been reduced to two nursings in 24 hours as the milk quickly deteriorates.

If weaning is begun at about the eighth or ninth month the proper strength and quantity of the milk in a single bottle should be established before additional bottles are added; after this has been adjusted to the needs and capacity of the infant, it is simple to replace nursings by additional bottles, usually at the rate of one per week.

Sudden weaning is dangerous to the infant and cruel to the mother.

There is no excuse for caked breasts or breast abscesses where the gradual method is used, while with the instantaneous method not only the baby and mother become upset, but I have seen the

whole family excited over the baby's refusal to take the bottle, the mother suffering agony in mind and body and the doctor quite at a loss over the baby's obstinacy.

In considering the artificial feeding of infants, I wish to emphasize that it is not as difficult nor need it be as intricate as certain mathematicians, chemists, metabolists, physiologists, and biologists, all finding expression at times through certain learned pediatricians, would make us believe.

The vast majority of infants will develop and grow normally if fed on  $1\frac{1}{2}$  ounces of whole milk per pound of body weight plus one ounce of sugar per day, provided they are properly cared for, managed and fed at regular 3 hour intervals.

Before starting a baby who has had difficulty in digesting milk it is advisable to clear out the gastrointestinal tract with 2 teaspoons castor oil and a high enema of one pint of water and to give the stomach a rest for from 6 to 12 hours.

The formula for the first week should be based on 1 ounce of whole milk per pound of body weight plus 1 ounce of sugar in 24 hours, a little less than it requires and wants. If at the end of the first week, the baby cries lustily, does not vomit, and does not have any diarrhea, the strength of the milk can be increased to the amount required for growth— $1\frac{1}{2}$  ounces per pound of body weight.

The most difficult feeding cases usually present vomiting as the most prominent symptom. The same method of starting with one ounce of milk per pound of body weight and then increasing to  $1\frac{1}{2}$  ounces per pound of body weight plus one ounce of sugar in 24 hours can be followed, but instead of using whole milk, skimmed milk should be used, which is obtained by removing from a standing bottle the 16 or 20 ounces.

When the vomiting stops every second day a little less can be removed from the top of the bottle so that gradually the milk again becomes whole milk.

If this method is intelligently applied, always remembering that a thin, long, crying baby requires a greater number of calories per pound of surface area than a fat phlegmatic infant—for of course Jacobi's statement that one requires two things to feed a baby properly, milk and brains, still holds true—the vast majority of infants will gain and grow.

While percentages do not enter into the calculations for these formulas, I try to keep the proportion of milk to water 1 to 2 under three months,  $\frac{1}{2}$  and  $\frac{1}{2}$  at about six months, and 2 to 1 about nine months and reach whole milk at about one year. The quantity in each feeding is usually one ounce more than the age in months, except during the first 3 months when it frequently is 2 ounces more.

The number of feedings is seven per day from birth, six usually at six months, five at ten months, and four at one year.

The interval is three hours from birth during the day and four hours at night; at six months the 2 a. m. feeding can be omitted and at ten months usually the 10 p. m. feeding. The best hours are 6, 9, 12, 3 and 6 through the day and 10 and 2 during the night.

When the four hour interval is used the best hours are 6, 10, 2 and 6.

This method is so simple and yet so successful, so easily adjusted to the metabolic and digestive requirements of each infant that when a baby does not thrive after it has been properly followed out one should consider the existence of a pathological condition like syphilis, hypertonia or pyloric-stenosis.

Many a child that has been properly fed in the first year and reached its first birthday in good health, in the course of the next few years loses in nutrition and resistance largely because mothers are at a loss what and how and when to feed their infants and experience great difficulty in obtaining definite instructions from their physicians. The importance of this period—the pre-school age—cannot be over-estimated. Not only the child's health and resistance are determined in this period, but its habits and prejudices are established, which often make it exceedingly difficult properly to nourish the child at any time. The malnutrition of the school child, its tendency to spinal curvature, flabby muscles or myocardial changes are very frequently the result of poor nutrition in the early years of life. During this period it is the family physician who must instruct the mother definitely how and when and what to feed her child, for in the vast majority of families no other physicians will have the opportunity. In order to make information on feeding available to the family physician in such form that he can easily transmit it, I have prepared a

schedule for the feeding of young children which divides the child into 6 feeding ages. During the first age, up to 9 months, the child should receive milk; from 9 to 12 months, bread, zwieback, toast and fruit juices should be added; 12 to 15 months, cereal and thickened soups; 15 to 18 months, green vegetables and potatoes; 18 months, egg and at 2 years, meat.

I know there has been a tendency in recent years to introduce new articles of diet during the first year more rapidly than in this diet. This has resulted partly from imitation of German methods and partly from the desire to supply all the substances now emphasized in nutrition, i. e., vitamins, amino-acids, anti-scorbutics, etc. In preparing diet lists I have very carefully estimated the quantity and kinds of food from an energy and tissue replacement requirement and have become impressed with the fact that it is almost impossible to under-feed a young child; that there is more malnutrition from over-feeding than from under-feeding. Morse has recently emphasized this viewpoint by making clear that children obtain more salts and vitamins than they are said to require when they are fed along old conservative methods of introducing new articles of food slowly and gradually and even where the quantity is carefully restricted.

For convenience of instructing mothers I have prepared these diets in two forms. One presenting sample menus; the other indicating what class of foods should be introduced at the various ages. If we succeed in establishing, during the first 2 years, proper habits of eating and accustom the child to the right kinds of food, we need have very little concern about his nutrition in the later years.

In medicine, as in art, those methods are the best methods that can most easily be presented and most easily followed. I hope that my presentation of the subject will assist in the popularization of our knowledge of maternal nursing, infant feeding and general dietetics and that I shall be pardoned for presenting to you material that has little that is new to recommend it. Let us remember that while we are scientists interested in a complete understanding of the intricacies of nature that we also are doctors, who, from the very meaning of their titles, are supposed to teach.



## PURPURA COMPLICATING OTHER DISEASES; ITS CLINICAL SIGNIFICANCE.\*

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Purpura is a hemorrhagic affection, characterized by the appearance of variously-sized, non-elevated, smooth, reddish or purplish spots, not disappearing on pressure. Purpura may occur as a distinct entity or as a complication of a severe systemic disturbance. As a distinct entity, purpura is frequently met with both in private practice, as well as, though more frequently, in any hospital or out-patient department, where children are treated. Simple purpura is usually mild, though at times its course may be rather prolonged. When it makes its appearance as a complication of an already existing disease, in that case one must be on the alert and give a guarded prognosis. Such complications are usually due to a severe and treacherous toxemia and in a great number of the cases reported in the literature the outcome has been fatal.

*Pathology.*—Török<sup>1</sup> believes that all purpuras have a similar origin, viz.:—some infective, toxic or autotoxic agent acting upon the vascular walls, reaching the parts affected through the blood stream. These agents may be various and can produce the same clinical and histopathological picture. Whatever clinical differences there may be are merely differences of degree.

Kromayer,<sup>2</sup> as a result of careful study, reports prodromal hyperemic spots which immediately precede the hemorrhage. There may be simple transudation of blood coloring matter or the blood may find exit through the rupture of a vessel wall as a result of an inflammation caused by a toxic agent. The effusion has its seat in the corium. The lesions are usually designated as petechiae, vibices, ecchymoses, and ecchymomata. The petechiae are mild, round, or oval spots; they vary in size from a pin point to that of a dime. Vibices is the term given to the lesions that appear in the shape of streaks, which may be an inch or more in length. Ecchymoses are large, round, or irregular non-elevated lesions. Ecchymomata is the term used when the lesions are large and form blood tumors.

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Purpura may complicate any disease but is most apt to manifest itself in the course of a severe infectious condition, or during the end stage of any of the wasting diseases, viz.:—dysentery, Banti's disease, etc.

*Rheumatism.*—When purpura appears in the course of this condition it is called peliosis rheumatica. The skin is covered with a mild form of petechial eruption; sometimes the eruption is limited to the extremities only, at times it is limited to the portions of skin in the neighborhood of the joints involved. This form of the disease is usually mild and yields to antirheumatic treatment promptly.

*Scurvy.*—In this disease it is hardly fair to call purpura a complication, for while it is a nutritional disturbance, it is mainly evidenced by hemorrhagic symptoms involving the mucous membrane, the bones, the subperiosteum as well as the skin. Not all cases, however, are accompanied by skin lesions, nevertheless some authors (Stelwagon) use the term purpuric scurvy synonymous with scurvy. The diagnosis of scurvy is usually easy if one will but remember the few pathognomonic symptoms, viz.:—evidence of pain on handling the patient, the patient being seemingly happy when left alone. The presence of a swollen joint or two, the characteristic gums, and with it a history of faulty feeding are all suggestive. The therapeutic test is most convincing as well as encouraging.

*Typhus.*—Here the petechial eruption may make its appearance on healthy portions of the skin, in addition to the macular typhus eruption; or the already existing eruption may undergo a hemorrhagic transformation; such is the case with very toxic cases. The parts usually affected are the flexor surfaces of the joints.

*Cerebrospinal Meningitis.*—This disease is at all times treacherous even in its mildest form; but the danger assumes a still much graver aspect when complicated with purpura. It is this type of the disease that has gained for itself the surname of "Black Death," in the course of the various epidemics in England as well as in our country. It may not be amiss to mention here that such a case might be mistaken for a case of serum disease in the course of a meningitis.

The observations that various workers have made, are worthy of note, viz. :—

Sharp<sup>3</sup> found meningococci in the capillaries of the ecchymoses of a case of meningitis in a child 3 years of age. Benda<sup>4</sup> was the first to report meningococci in the cellular masses surrounding the arterioles, from sections made from the skin of a case of meningitis purpura. Pick<sup>5</sup> showed typical meningococci in the skin capillaries, from specimens taken from 2 soldiers who died from purpuric meningitis. Netter & Salanier<sup>6</sup> explain the origin of the purpuric lesion in meningitis as being due not to the toxemia of the disease, as is usually understood, but to a deposit of meningococci around the vessels. These workers have demonstrated diplococci in smear as well as in culture in specimens taken from purpuric patches, which were decolorized by Gram's method, similar to those found in the cerebrospinal fluid of meningitis cases. The same authors make an interesting point by stating the fact that one of their cases, which died from purpura and from which they obtained the meningococci, never developed meningitis. They comment on this by saying that one should bear this in mind when confronted by a severe case of purpura with toxic symptoms, i.e. high temperature, vomiting, chills, stupor, prostration, etc., and when added to it a negative spinal fluid and absence of the usual symptoms of meningitis, one should suspect the meningococcus and attempt to find it in the purpuric spots and thus clear up the case even before there develops the typical meningeal symptoms. These authors have succeeded in diagnosing one such case in a 10 months old child. They failed to find the meningococcus in the vessicles in 6 cases of meningitis accompanied with herpes.

*Variola Purpurica.*—As its name implies, it is a purpuric form of variola. At the end of the initial stage, petechiae or ecchymoses usually appear. The rash is of a dark-red or purplish color accompanied by severe constitutional symptoms. This type soon proves fatal.

*Scarlet Fever.*—Here, when purpura occurs, it does so late in the course of the disease. Welch & Schamberg<sup>7</sup> report 2 cases of scarlet fever and purpura. One showed the purpuric lesions on the 14th and the other as late as the 17th day after the onset of the scarlet fever symptoms. One of these 2 cases recovered. The necropsy of the second one revealed a right sided pleurisy,

hemorrhages into the mediastinum and peritoneum, also vegetations on the mitral and aortic valves. Biss<sup>8</sup> reports a case in a boy 3½ years old, who, on the 19th day of his scarlet fever, developed pin point purpuric spots, followed by hematemesis and hematuria to which he rapidly succumbed. On autopsy, they found that the kidneys had undergone complete fatty degeneration. I recall one case that I saw some years ago that became ill with a severe scarlet fever. Within 24 hours the rash became quite dark and soon the body showed some widely scattered purpuric lesions. That child grew progressively worse and died within 3 days.

*Measles.*—This disease may prove to be a mixed infection and thus show a purpuric eruption. Berg<sup>9</sup> reports one such case with hematuria, bleeding from the nose and bowels, the patient dying within a short time.

These cases are rare and they may occur in the course of epidemics, and are usually spoken of as black or malignant measles. They sometimes occur in children who have a debilitated constitution due, it may be, to a prolonged previous illness, i.e. enteritis, pertussis, etc. The rash may be poorly distributed and livid. The petechiae may show from the start or may be ushered in later in the course of the disease. The predominating feature in these is the severe nervous symptoms similar to those seen in typhoid. Delirium is a very prominent symptom, also dry tongue, cold extremities, rapid and irregular pulse. O'Shea<sup>10</sup> reports 2 such cases. One of his patients was a child of 5 years of age who was quite prostrated from hemoptysis, bronchitis, subconjunctival hemorrhages, enlarged liver and enlargement of the submaxillary lymph nodes, and who recovered after 3 weeks of severe illness. His second case, a child 2 years old, who developed such additional complications as bronchopneumonia, meningeal symptoms, Cheyne-Stokes breathing, irregular and rapid heart, cyanosis and convulsions, temperature 107.5°, incontinence of urine and feces, finally died.

*Diphtheria.*—Here the purpura may manifest itself in the form of fine and very indistinct petecchiae, usually covering the abdomen or chest. In extremely toxic cases, the eyelids may also show ecchymoses. This complication may appear at any stage of the disease even at the time when the membrane has partly or even completely left the throat. Most authors believe this to

be a mixed infection and the streptococcus the responsible organism. The patient may complain of nausea or he may vomit, the face is pale and apathetic, or a worried expression may be recognized; the pulse is sometimes rapid and soft, but a very slow and irregular pulse is more apt to be the case. The first heart sound is faint and there is almost always a reduplication of the heart beats or an arrhythmia. There may be enlargement of the liver which is very tender to the touch. Some authors have reported this complication as late as the second week, when the patient is usually convalescing. It is advisable therefore to keep a watchful eye over these patients, especially after the acute symptoms have passed. Recently we had an opportunity to observe closely 2 such cases at the Kingston Ave. Hospital. Both cases died within 5 days after the onset in spite of the most intensive treatment and early administration of antitoxine in large doses. One of these cases did not seem to be critically ill. The throat symptoms were rather mild as compared with some diphtheria throats. It was on very close examination, however, that we were able to point out the purpuric eruption to the house staff, and with it a word of caution as to the prognosis. That patient died later from heart failure (?), an end result to be expected with most of these cases. These cases have left an indelible mark on me as to the treacherousness of this complication in diphtheria. The term complication, as applied to a case of diphtheria, may be open to criticism for it is in reality a manifestation of a mixed or toxic infection. However, that matters little, for neither the treatment nor the prognosis is in any way benefitted by either view.

Purpura may occur at the close of very exhausting diseases, especially enterocolitis. Donald<sup>11</sup> reports a case of bacillary dysentery which showed a purpuric rash, and to which the patient finally succumbed.

Some years ago I recall a case of cerebral chorea (the only case I have ever seen). The twitchings were so severe that the patient had to be tied to the bed, and no remedy was of any value to lessen the extreme nervous irritability. That patient finally developed a severe form of purpura, the eruption covering the greater part of the body and died 4 days later.

*Whooping Cough.*—The pathology in this condition as far as

the purpuric complication is concerned, is not quite understood. It is possibly due to an increased intravenous pressure superadded to some changes in the vessel wall.<sup>12</sup> Canelli<sup>13</sup> reports 2 cases that came to autopsy. These cases showed minute hemorrhagic foci in the brain and meninges. The author in his comment states that he believes them to be due to the spasms causing an increased blood pressure acting upon vessels weakened by the pertussis toxins.

In a general way it may be said that we may expect this complication in any septic condition. Kerley<sup>14</sup> reports a case that died from septic thrombosis, involving the jugular vein and which was accompanied with an extensive purpura. He was able to demonstrate the streptococcus in pure culture from the patient's blood.

Any of the severely acute, as well as the chronic blood diseases, viz.:—leukemia, Banti's disease, pernicious anemia, etc., may present some form of purpura. In fact, in leukemia one always expects hemorrhages from the mucous membranes as well as under the skin, some time during the course of the illness.

Finally, some authors, notably Stelwagon, speak of a form of urticaria at times complicated by purpura, which is not very serious.

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# ARCHIVES OF PEDIATRICS

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## A CLINICAL AND METABOLIC STUDY OF ACRODYNIA.\*

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Toronto.

Owing to the fact that so little is known as to the etiology of this condition, we felt justified in presenting this contribution to add to the material already brought forward. This peculiar disease, which was first brought to our notice in June, 1918, like many others, we felt to be more or less like pellagra; but, after consultation with Professor Andrew Hunter, who had become familiar with pellagra as biochemist at the Pellagra Hospital, established by the United States Public Health Service, this condition we excluded. It was not until Weston's<sup>1</sup> article appeared,

\*Read by invitation before the North Coast Pacific Pediatric Society, Portland, Oregon, June 29, 1921.

From the wards and the Nutritional Research Laboratories of the Hospital for Sick Children and the Department of Pediatrics, University of Toronto.

citing Bilderback's<sup>†</sup> description of the disease, that we had any knowledge of the condition as an entity. The appearance of this article, followed shortly by that of Byfield<sup>2</sup>, stimulated us to investigate this interesting and increasing disturbance. We do not propose to enter into an exhaustive discussion of the literature but merely to present our findings, with comments as to the possible etiology of the disease.

GENERAL DESCRIPTION OF THE CLINICAL FINDINGS. The disease presents a very complex picture that almost beggars accurate description. The respiratory, nervous and cutaneous systems appear to be most seriously involved, while the digestive disturbances that arise in the course of the disease are probably only of a secondary character. There is a constant nasopharyngitis, occasionally developing into a bronchitis or bronchopneumonia. The important changes in the nervous system are of a sensory or trophic character. Paresthesia of the extremities is fairly constant and is an apparently distressing symptom, which frequently causes the children to scratch or rub and occasionally chew their extremities. Cutaneous sensibility to pin pricks is absent in some instances. The deep reflexes are uniformly diminished and occasionally absent and in one instance there existed a partial pseudo-paralysis of the lower extremities. In all cases there is exhibited a rather characteristic attitude, that of lying on the hands and knees with the head buried in the pillow. In every instance photophobia is a symptom and in fact is usually referred to by the parents. All cases present a more or less wretched appearance, quite distinct from the appearance of uncomplicated malnutrition.

*Nervous System.* Paresthesia of the toes, feet, fingers and hands is very common, and is of a distressing nature. One patient (McFeeters) complained bitterly of the pain in the feet and lower parts of the legs and begged to have a hot water bottle, frequently pleading to have the bed clothes raised from her feet, as their weight seemed to produce discomfort. A few of the cases showed diminished cutaneous sensibility to pin pricks, although this was not a reliable sign, owing to the tender age of the majority of the cases. Photophobia, in varying degrees,

<sup>†</sup>On personal communication with Bilderback it was learned that the cases recorded by Patrick and quoted by Weston were patients of Bilderback, Patrick assisting him at that time.



is present in all instances, causing the child to bury its face in the pillow or lie with its arms folded across its eyes. The deep reflexes are diminished in all, and in one instance a definite pseudo-paralysis existed. Dullness and apathy is a most constant symptom, at times alternating with restlessness and almost complete lack of sleep.

*Cutaneous System.* The character of the skin lesions is most diagnostic. It consists of a uniform involvement of both fingers and toes, frequently extending as high as the wrists and ankles. The eruption was erythematous in character, more marked on the fingers and toes, producing an almost edematous appearance of the skin of the extremities. The erythema usually fades at, or about, the ankle or wrist. In most instances there exists on both palms and soles a desquamation of a "pin prick" character or larger, quite distinct from the desquamation in scarlet fever; very rarely are these desquamated areas larger than the head of a pin. This peeling invariably extends to the finger tips and continues along the margin of the nails, which occasionally show trophic darkening and softening. The skin eruption is observed to fade as the child's general condition improves. Excessive perspiration is also a most distressing symptom; in many instances the child's clothes and bed clothes are saturated most of the time. This of necessity tends to produce a macerated condition of the skin and not infrequently, in addition to the eruption already described, a vesiculopustular eruption extending over the entire body.

*Teeth.* In 2 instances in our series, some of the teeth loosened and fell out without any previous pathological change of the gums.

*Digestive System.* Loss of appetite was a fairly constant symptom in our cases but we do not lay such stress on this point as Byfield; rather did we consider the temporary loss in appetite due to the original nasopharyngitis with its resulting absorption of toxins. Such loss of appetite one observes in almost any infection in young children and more especially when accompanied by a definite toxemia. The majority of the children are constipated, although in 2 instances there was a tendency towards looseness but no definite diarrhea.

*Respiratory System.* In each case there was a clear-cut history of recurrent nasopharyngeal infection and every physical

examination revealed the nose and throat to be either in a chronically inflamed condition or showing an exacerbation of a chronic state with a varying amount of post-nasal discharge. Quite frequently the parents mentioned the fact that the child's "nose had been running" for weeks. In 1 case there existed a complicating otitis media and cervical adenitis, while 2 infants developed acute bronchopneumonia which terminated fatally. It was observed that on the subsidence of the nose and throat involvement the children began to improve; especially was this noticeable in one case on the removal of the tonsils and adenoids. This latter point has also been commented on by Byfield. There are no signs directly attributable to the gastrointestinal tract beyond the fact that in 1 instance there was an intercurrent pyelitis which we felt bore no relation whatever to the underlying condition. The weight curve in all instances is much below the standard.

**LABORATORY FINDINGS.** The only point of any significance was the fact that there existed fairly regularly a relative polymorphonucleosis and occasionally an increase in the total number of leucocytes. The counts ranged from 12,000 to 24,000 and the polymorphonuclears from 59 to 72 per cent. Not infrequently there existed a mild degree of secondary anemia, the lowest red count being 3,900,000, and hemoglobin 68 per cent.

The Wassermann reaction on both spinal fluid and blood was uniformly negative. Further examination of the spinal fluid revealed no pathological changes. Cultures from the tonsils and post-nasal spaces showed in every instance a mixed infection and on no occasion were any organisms isolated resembling the influenza bacillus. In one case, (McFeeters) the child's serum was tested for the presence of agglutinins against several strains of influenza bacilli but with negative results. (See Table 1.)

From the accompanying Table 2 it will be seen that the seasonal incidence is certainly suggestive, in that 5 of the 7 began in the seasons of the year that have the highest incidence of respiratory infections; the 2 months (May and June), in our climate, not infrequently show a high incidence of respiratory infections. None of our cases commenced in the summer months. This incidence is at least suggestive of the possibility that infection bears a very important rôle in the etiology of this condition. Most of our cases came from the city.

TABLE 1.

Serum was diluted with normal saline and to 0.5 c.c. of each dilution was added an emulsion of *B. influenzae* using 6 different strains obtained from the bacteriological laboratory of the University of Toronto. These were incubated at 37° C. for 4 hours, at the end of which time no agglutination had occurred. They were then placed in the refrigerator overnight and at the end of 14 hours the readings were as follows:

Strain No.	Serum Dilutions after the addition of emulsion.				Control Sal. Emul.
	1-5	1-10	1-20	1-49	
1	0	0	0	0	0
2	3	2	1	0	0
3	4	4	4	4	4
4	2	1	0	0	0
5	4	4	4	4	4
6	2	1	0	0	0

4—approximately 100% agglutination.

3—approximately 75% agglutination.

2—approximately 50% agglutination.

1—approximately 25% agglutination.

Nos. 3 and 5 were self-agglutinating and can be ruled out.

No. 1 is negative.

Nos. 2, 4 and 6 show partial agglutination and in the more concentrated dilutions but it is doubtful if this is of any significance as it was not present at the end of 4 hours.

TABLE 2.

## Seasonal Incidence

Number of cases observed during a period of three years.

Year	Month	No. of Cases
1918	June	2
	November	..
1919	May	1
1920	September	..
	October	3
	November	..
1921	April	1 up to May.

AGE INCIDENCE.—One case occurred at 6 months; 4, between 6 months and one year; 3, between one and 2 years, and one, over 2 years.

FOCAL INFECTION.—In all instances there was evidence of disease in the nasopharynx; more pronounced in some than others. In 2 children, death took place from an extension of the process in the nasopharynx to the lungs, terminating in a bronchopneumonia. In other cases, there were definite signs of a bronchitis. Six of the 8 showed a thermal rise at one time or another during the course of the disease.

#### CASE REPORTS.

Goddard, 6 months of age. Admitted, Oct. 29, 1920. Discharged Jan. 18, 1921. Weight, 10 pounds.

*Complaint on Admission.*—Failure to gain in weight for one month, and more or less loose cough since birth. She was breast fed for a period of one and a half months, and weaned because the mother thought the food was not satisfying her. She was then given condensed milk until 7 months of age, and shortly before changing to the succeeding feeding the stools became loose. She gained very slowly but showed no other signs of digestive disturbance. Her final food consisted of glaxo for 2 months; on this the stools still continued loose, and the infant did not appear to thrive.

*Examination.*—Fairly well nourished and developed. Not acutely ill. No signs of rickets. Definite chronic nasopharyngitis with congestion of both drum membranes. Both cheeks show discrete red patches and there was a mild degree of photophobia. The child preferred to lie on her face with head buried in the pillow. Presented a typically wretched appearance.

*Extremities.*—Both hands and feet were reddened and moist, and the skin edematous, neither hands nor feet showing any signs of patchy desquamation. Both ankle and knee jerks normal. Reacted well to pin prick.

*Fundi.*—normal. Photophobia present.

*Progress.*—Dec. 6 and 7. Ptosis of the right eyelid and partial of left. Nasal discharge disappeared in one week.

*Urine.*—negative.

*Blood.*—R. B. C., 4,400,000. W. B. C., 11,700. Hemoglobin, 105 per cent. Polymorphonuclears, 59 per cent.

*Digestion.*—normal.

*Urine culture.*—showed no organism resembling *B. influenza*.

*Spinal fluid normal.*—*von Pirquet* and *intracutaneous* tests negative.

Throughout the stay in the hospital the child's weight remained stationary. There was no rise in temperature or further evidence of extension of the nasopharyngeal infection.

Loss of appetite did not appear to be a feature of the case, the child usually taking all the food offered. Her digestion, except for a slight tendency to looseness, remained normal; she of course did not gain in weight in spite of her sufficient caloric intake. The diet consisted almost entirely of protein milk powder (on account of loose stools), with added corn syrup and a cereal milk mixture. Cod-liver oil was given empirically in 15 to 20 drop doses, 3 times a day, throughout her stay in the hospital. Her photophobia never entirely disappeared, neither did the bright color on her cheeks, but she recovered from the general wretchedness and unhappy condition in about 2 months following admission.

*Comment.*—The most striking feature in this case was the general wretched condition of the child, coupled with the vasomotor disturbances and the photophobia, all of which was associated with a fairly constant chronic nasopharyngitis.

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Burke, 11 months of age. Admitted Nov. 23, 1920. Discharged Dec. 22, 1920.

Admitted to the hospital on account of restlessness, irritability, rash on hands and feet which were cold and moist, associated with some nasal discharge for a period of 3 weeks. Previous feeding history—had been breast fed for 3 months followed by rational dilutions of whole cow's milk with added carbohydrate.

*Examination.*—Weight, 12 pounds. Fairly well developed, but a poorly nourished infant. Not acutely ill. There was a purulent nasal discharge with congestion and swelling of the whole nasopharynx. No evidence of rickets. Extremities—feet and hands cold and blue. Under pressure the color returned very gradually. Both cheeks and the tip of the nose were reddened; there was only a mild degree of photophobia. Felt pin pricks readily. Dorsalis pedis arteries distinctly palpable. Reflexes normal and equal. *Fundi* normal.

*Laboratory findings.*—W. B. C., 13,000. R. B. C., 4,200,000. Polymorphonuclears, 60 per cent. Hemoglobin, 80 per cent.

*Urinalysis*—normal.

Repeated cultures from the nasopharynx revealed no organism resembling the B. influenza, morphologically or culturally.

*Cerebrospinal fluid.*—showed no abnormality.

*Tuberculin skin tests* and *Schick tests.*—negative.

*Blood culture.*—sterile.

*Progress.*—Throughout the child's stay in the hospital it gained one pound. The diet consisted of dilutions of lactic acid milk with added corn syrup in addition to a cereal milk mixture sufficient to meet the caloric requirements. The child's general condition improved and the nasal discharge gradually subsided. The appearance of general wretchedness, shown on admission, along with the photophobia and burying of the head in the pillows, gradually disappeared. At no period was there any lack of appetite.

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Ashworth, 10 months of age. Admitted Sept. 23, 1920. Discharged Dec. 17, 1920.

*Complaint on admission.*—Crying, restlessness, with loose stools over a period of 2 months. The infant had been nursed for 3 months and then given Mellin's food for 1 month, followed by whole milk dilutions and glaxo, the latter being given for only one month. The milk dilutions were given under advice of a clinic physician and theoretically appeared adequate in every respect. The mother came to Canada in July and she states that up to this time the child had been perfectly well but from about the date of arrival in this country he began to be restless, crying a great deal, and had numerous loose stools each day.

Examination showed a moderately well developed but poorly nourished child of 15 pounds weight. In every respect it appeared miserable. There was some chronic nasopharyngitis with enlarged adenoid tissue, cheeks and forehead reddened. Photophobia was present to such an extent that the child either lay on its face in the bed or bent forward in a sitting position, covering its face in the bed clothes for protection from the light. The general muscular tone was poor and there existed a moderate degree of dehydration, apparently as a result of the recent

diarrhea. The skin of the extremities was thickened, moist, cold and bluish, showing numerous pin prick areas of desquamation. Deep reflexes were present and equal. Dorsalis pedis vessels difficult to palpate.

*Laboratory findings.*—Urine examination, negative. R. B. C., 3,900,000. W. B. C., 14,000. Polymorphonuclears, 61 per cent. Hemoglobin, 68 per cent. Endothelial cells, 2. Eosinophiles, 1. Lymphocytes, 39. Cerebrospinal fluid—normal. Tuberculin skin tests—both intracutaneous and von Pirquet—negative. Urine cultures—sterile.

Laryngeal and pharyngeal cultures made on 4 per cent. glycerine neutral agar and subcultures made, but no organisms were found agreeing culturally or morphologically with influenza.

*Progress.*—For the 5 days following admission the temperature ranged between 99° and 101°; from this period till discharge from the hospital there was no further elevation. For the first 6 weeks in the hospital, the weight remained practically stationary; after this there took place a gradual increase, until on discharge the weight was 17 pounds. Throughout the period in the hospital, the child was fed protein milk powder diluted at first, and finally with corn syrup and a cereal milk mixture added. For about the first 2 weeks the child refused about one-third of the quantity offered but after this there was no trouble in getting him to take the food offered. The stools were always well digested.

*Treatment.*—Atropine sulphate 1/1000 sol., gtts. 2. was given in each feeding on account of the excessive moisture of the skin. In order to ensure a sufficient intake of fat-soluble A. vitamin, cod-liver oil in 20 minim doses was given 3 times daily for the last 6 weeks in the hospital.

The improvement in the child's condition was very gradual. The photophobia had disappeared entirely in 6 weeks, and in 2 months the child was able to stand. The circulatory disturbance, however, continued till discharge but very much less marked in severity, there being only a faint tendency towards clamminess and hyperemia when the infant left the hospital. When last seen, onemonth following discharge, the child had gained another pound, although in the interval it had had a mild upper respiratory infection. The diet remained unchanged.

*Discussion.*—In this particular case the manifestation of an upper respiratory infection did not play such a prominent part in the clinical picture. On the other hand, there was certainly no clinical evidence of rickets or scurvy, in fact nothing to suggest a food deficiency. The improvement was very gradual and was marked by an absence of any further respiratory infections and did not appear to be influenced to any degree by either the atropine or cod-liver oil.

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McFeeters, 3 years of age.—Referred, as a private patient, with a complaint of anorexia, irritability, weakness of the lower extremities, cold hands and feet with a cough and nasal discharge existing for almost 3 months. The child was breast fed for 8 months followed by "table food" shortly after weaning. She had had no previous illness. About 9 months previous to illness, mother observed that the child's appetite began to fail followed by a gradual loss in weight and approximately 6 months following this, observed a "rash" on the hands and feet. She frequently complained of the extremities being "itchy, sore and cold." Since infancy there has been a fairly constant cough, varying at times, and usually associated with some nasal discharge. About 2 months previous to admission, 5 of her teeth fell out, one after the other. This loss of teeth was associated with some ulceration around their margins while the teeth themselves were in perfect condition. Throughout the entire 9 months the mother had noticed excessive perspiration, necessitating the frequent changing of the clothing.

*Examination.*—Well developed and moderately well nourished child, appeared miserable and unhappy. Several teeth missing although there was no evidence of ulceration. The tonsils were chronically inflamed and enlarged with considerable adenoid tissue, and post-nasal discharge, this being quite sufficient to account for the loose cough which the child had. The lungs were clear. The skin was covered by a pustulovesicular eruption (miliaria, infected). The skin of the palms and soles was thick, edematous and macerated, showing irregular desquamated patches. She did not appear to want to use hands or feet and when they were disturbed, she became more irritable, as if in pain. The deep reflexes were not obtained and she experienced some difficulty in



moving the legs (pseudo-paralysis). Temperature fluctuated between 99° to 100°, and occasionally reached 101°.

*Laboratory findings.*—Urinalysis, negative. Blood, R. B. C., 4,300,000. W. B. C., 24,750. Hemoglobin, 105 per cent. (extremities blue). Polymorphonuclears, 72 per cent. Cultures and subcultures from both nares, post-nasal space and from the tonsils revealed no organisms suggestive of influenza. Blood Wassermann—negative. Intracutaneous and von Pirquet tests—negative. Spinal fluid—normal. Serological tests—see sheet.

*Comment.*—This child showed more definite evidence of chronic nasopharyngeal infection than any other case in our series. The infectious nature was still further confirmed by the very definite leucocytosis. The skin changes were characteristic, while the pseudo-paralysis was not observed in any other case of the series and probably serves still further to bear out the toxic nature of the disease.

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DeCudmore, 17 months of age, admitted April 1, 1921. Private patient, first seen April 1, 1921, with a complaint of anorexia, restlessness and tendency to avoid the light. The previous history was not suggestive except that the infant had been breast fed for 3 months and then fed plain dilutions of cow's milk and water. For 1 month previously the mother had noticed that the child "buried its face in the pillows" while its cheeks were frequently observed to be red and "inflamed" and the hands and feet red and cold. About 6 weeks previous to this, the child had a severe head cold, and 2 weeks subsequently the above symptoms appeared.

*Examination.*—Weight, 21 pounds, 13 ounces. Well developed and fairly well nourished. Tonsils enlarged and chronically inflamed. No evidence of rickets. Circulation sluggish in the hands and feet, which were cold and blue.

*Treatment.*—The child was given a mixed diet with cod-liver oil (empirically) and, when last seen in May, showed definite signs of improvement.

*Comment.*—A mild case of acrodynia with very definite nasopharyngeal infection and showing no digestive disturbance except the usual anorexia associated with an ordinary infection of

mild degree. It is interesting to note that this child improved rapidly with the onset of the mild spring weather.

Lewis, 21 months of age. Admitted May 19, 1919. Discharged Sept. 4, 1919. Private patient, referred in May, 1919, with a complaint of recurring attacks of bronchitis since one year of age and for the past few weeks cold and red extremities. The feeding history was as follows: breast fed for 1 year followed by cow's milk dilutions, puddings, vegetables and bread stuffs. With the exception of whooping cough, the child had had no previous illnesses other than the bronchitis.

*Examination.*—Weight, 15 pounds, 4 ounces. No evidence of rickets. Fairly well developed but poorly nourished. A few scattered râles over both lungs. Tonsils enlarged and congested with considerable post-nasal discharge.

*Laboratory findings.*—R. B. C., 4,920,000. Hemoglobin, 80 per cent. Urinalysis—acid, numerous bacilli and a few pus cells.

*Progress.*—The infant was admitted to a private hospital where it was given a mixed diet with cod-liver oil. The weight gradually dropped to 14 pounds and then rose to the admission weight before discharge from the hospital. For the first 10 days there was an occasional rise in temperature possibly due to the nasopharyngitis, as the existing pyelitis was readily controlled by massive doses of potassium citrate. The child was discharged September 11, 1919, and when last seen on May 15, 1920, at 3 years of age, was in perfect condition and weighed 31 pounds.

Wright, 16 months of age. Admitted June, 1918. Private patient referred in June, 1918, for general irritability, poor appetite, cold hands and feet since April. The mother reported that so far as she knew the infant had never had an attack simulating influenza. Breast fed 1 month followed by rational milk and water feedings with addition of cereals and milk puddings.

*Examination.*—Weight 21 pounds, 9 ounces. Fairly well developed and nourished. No evidence of rickets. Definite photophobia, with red patches on both cheeks. The child quite frequently was seen to bury its face in the pillow. Several teeth showed considerable ulceration around the gums and for the first 10 days the temperature ranged between 99° and 102°. For the

following 3 months the child suffered from an occasional mild nasopharyngitis.

*Progress.*—The symptoms gradually subsided in about 3 months. In May of the following year, the child weighed 29 pounds. When last seen in April, 1921, its weight was 35 pounds. There was no subsequent illness except an occasional attack of nasopharyngitis.

*Treatment.*—Consisted only of regulation of the diet.

*Comment.*—In this case there was no evidence of a deficiency in the diet. The only positive sign of any disease was occasional attacks of nasopharyngitis, one of which was associated with an ulcerative stomatitis.

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Calvert, 13 months of age. Admitted November, 1918. Private patient referred in November, 1918, with the symptoms of irritability and rash on the hands and feet for about 5 months. The child was nursed for 4 months and since then badly fed with "tastes" of everything from the table.

*Examination.*—Weight 15 pounds, 10 ounces. Moderately well developed but poorly nourished showing no evidence of rickets. There was very definite dental caries with extensive ulcerative stomatitis. Nasopharynx definitely congested. Hands and feet characteristic.

*Progress.*—The child was sent to a private hospital for observation purposes and during this time it periodically refused its food and had a slight rise in temperature; its weight fell to 12 pounds and gradually rose to 15 pounds before death. There was an occasional rise in temperature always accompanied by an exacerbation of the nasopharyngitis. Ten days before death, the child developed a bronchopneumonia.

*Comment.*—Chronic nasopharyngitis with acute exacerbations terminated by a bronchopneumonia were the most striking features concerning this case.

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DIFFERENTIAL DIAGNOSIS.—The disease with which we confounded acrodynia at first was of course pellagra; but after following the first case, it was plain to us that the condition was quite different. The most important points of differentiation are:

(1) In pellagra there exists a definite line of demarcation in the skin eruption.

(2) There exists a common dietetic error.

(3) Pellagra is unheard of in our locality.

Motor neuritis was also considered but the sensory changes were so definite in acrodynia that motor neuritis was readily ruled out. A trophoneurosis, such as erythromelalgia, might of course be considered on account of the slight fundamental resemblance but certainly does not fit in with the other signs of the condition. Other infections, especially those producing toxic effects, such as scarlet fever, might be considered, but the prolonged course of acrodynia served to exclude this condition. Acrodynia appears more closely associated with influenza than any other condition in our experience. It seems unreasonable to believe that many of these cases could pass unrecognized by pediatricians, yet it is only in the last 5 years, and especially in the past 3 years, that any particular mention has been made of the condition. The belief that acrodynia is on the increase may be confirmed by the fact that 8 cases have been reported in Portland, Oregon, by Weston<sup>1</sup>; 13 cases, in Cincinnati, Ohio (quoted by Byfield),<sup>2</sup> and 5 by Cartin,<sup>3</sup> together with sporadic cases in Omaha, Chicago, Detroit and Des Moines, (also quoted by Byfield) and in addition, our 8 cases.

This very fact of increased incidence compels one to associate the condition as a possible effect of the recent influenza epidemic. This statement is still further borne out by the fact that the first report of acrodynia appeared in 1828 exactly within a year of the first pandemic of influenza. Leichenstern<sup>4</sup> states that "there can be no doubt but that influenza has been the direct cause of numerous polymorphic diseases of the nervous system. The latest influenza pandemic (1889-90) and its recurrences have taught us something quite new in neurology, namely an acute infectious disease which, compared with all others, is characterized by its striking neurotoxic effects." Most of the symptoms of acrodynia point to the obscure action of some toxic material, while the previous history and general progress, while under observation, tend to exclude any serious dietetic deficiency.

CHEMICAL FINDINGS.—In the case of 2 of the children suffering from acrodynia, the quantitative collection and analysis of the

urine and the feces, together with representative samples of the food, were made in order to determine whether or not any abnormality in the digestion, absorption, or retention of the food could be connected with this condition. One child was studied for a period of 4 days, and the other for 3 days. One infant of 10 months was taking protein milk and some cereal milk mixture; while the other, 3 years of age, was given a mixed diet including milk. In the second case, the food collection was begun a day in advance of the collection of the excreta. Both children had a normal amount of feces on the day preceding the period of collection.

The determinations were made on the freshly collected urine, and on the food and feces after they had been dried to constant weight on the water-bath. Average daily values for intake and output were obtained for fat, nitrogen, total salts, calcium, magnesium, phosphorus, sodium, potassium and chlorine.

Fat was determined in dried food and feces by a modification of the Roesse-Gottlieb<sup>5</sup> method; nitrogen in the urine, dried food and feces by the Kjeldahl-Gunning method; and total ash by the Stoelte method. Chlorine was determined by titration according to Volhard; the dried food and feces were extracted and the protein precipitated with nitric acid and ferric alum, and the chlorine estimated in the filtrate. The other constituents of the ash were analyzed by standard gravimetric methods. Folin acidity was determined daily in the urine, along with ammonia and urea in the case of one child. Uric acid was estimated by the Folin-Schaffer method in the composite urine in each case. Tables 3 and 4 give for the two children (C. A. and C. McF.) respectively, average daily values in grams for intake and output in urine and feces of the constituents determined. Table 5 gives the intake and the loss in the feces of fat, nitrogen and total salts of the more severe of these two cases in comparison with the same values for a mild case of chronic intestinal indigestion.\* The children were girls of the same age and similar weight, taking a mixed diet including milk, although the child with acrodynia was taking less milk and more solid food than the other.

The most marked abnormality to be noted in the values here presented is in the relatively large excretion of nitrogen in the

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\*These figures are taken from some work done in this laboratory, results of which are to be published later.

TABLE 3.

C.A. Acrodynia. Age 10 months. Weight 6.9 Kg. Diet 35 ounces. Protein Milk and 2 oz. Cereal.										
	Total Fat	Total Nitrogen	Total Salts	Ca O	Mg O	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Na <sub>2</sub> O	Cl.	
Average Daily Intake .....	17.186	5.070	6.232	1.533	.174	2.320	1.356	.445	.884	
Average Daily Output in Feces. ....	1.609	.397	2.204	.994	.094	.603	.134	.022	.032	
Average Daily Net Absorption.....	15.577	4.673	4.028	.539	.080	1.717	1.222	.423	.852	
Average Daily Output in Urine.....	.....	4.150	2.615	.082	.022	.578	.868	.350	.480	
Average Daily Retention.....	15.577	.523	1.413	.457	.058	1.139	.354	.073	.372	
Percent of Intake Retained.....	90.7	10.3	22.7	29.8	33.3	49.1	26.1	16.4	42.1	

TABLE 4.

C.MeF. Acrodynia. Age 3 years. Weight 11 Kg. Diet. Soft Diet including Milk.										
	Total Fat	Total Nitrogen	Total Salts	Ca O	Mg O	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	Na <sub>2</sub> O	Cl.	
Average Daily Intake.....	28.669	4.766	7.235	.878	.129	1.866	1.542	1.257	1.539	
Average Daily Output in Feces.....	2.270	.276	1.572	.651	.076	.606	.100	.024	.007	
Average Daily Net Absorption.....	26.399	4.490	5.663	.227	.053	1.260	1.442	1.233	1.532	
Average Daily Output in Urine.....	.....	4.648	5.587	.197	.081	1.078	1.494	1.237	1.363	
Average Daily Retention .....	26.399	— .158	.076	.030	— .028	.182	— .052	— .004	.169	
Percent of Intake Retained.....	92.1	..	1.1	3.4	..	9.8	..	..	11.0	

urine, resulting in an abnormally low percentage retention for a child of that age. Normally an infant on a milk diet retains 20 to 25 per cent. of the intake of nitrogen. Even in chronic malnutrition there is commonly a good retention of nitrogen. In a study of 7 children with 32 periods of observation, there was found a retention of over 20 per cent. of the intake in twenty periods, in 12 of which the retention was over 30 per cent., while it was less than 10 per cent. in only 8 of the periods.<sup>6</sup> The salt retention is however as high as normal, that of phosphorus and of chlorine being exceptionally high.

It is particularly to be noted that there was no abnormal loss of nitrogen or any of the other constituents in the feces, the latter being quite normal both in daily amount and in composition. Both the ammonia coefficient and the absolute value were normal. The average daily excretion was 0.22 gm. nitrogen as ammonia, which is 5.3 per cent. of the total nitrogen. Folin acidity averaged about 84 c.c. N/10 daily. Uric acid was not abnormally high, uric acid nitrogen being 1.76 per cent. of total nitrogen. Johnston and Veeder<sup>7</sup> give as the average value for uric acid excretion by children on a creatin-free diet 2.2 per cent. nitrogen of the total nitrogen, with a range from 1.5 per cent. to 2.9 per cent. From the values for Folin acidity and for ammonia in the urine it would seem unlikely that there was any acidosis present. The child was practically constant in weight during the period of observation.

Here are given the values for the more severe case. The same abnormal nitrogen metabolism as is seen in Table 3 is shown here. The excretion of nitrogen in the urine by this child, however, is sufficiently great to cause a negative balance. In this table it is seen that the bases show practically a negative balance; the values for calcium only showed a small retention. As in Table 3, the highest retentions for the ash constituents are those of phosphorus and chlorine. Folin acidity in the urine was considerably higher than with the first child, namely about 150 c.c. N/10 per day. The uric acid nitrogen was higher than normal, 4.06 per cent. of total nitrogen. Johnston and Veeder<sup>7</sup> give as the values on a standard diet not creatin-free, an average of 1.3 per cent. of total nitrogen, the range being 0.8 per cent. to 2.0 per cent. The rather high folin acidity may be connected with the high

uric acid in this case. As in the first case, it is seen that the urine and not the feces is responsible for the excessive loss of nitrogen and bases, since the output in the feces was quite normal.

The normal character of the feces in this case is brought out clearly in Table 5, in which a comparison is made of their general composition with that of the feces of a mild case of chronic intestinal indigestion. The difference here shown, both in the total daily amount and the percentage of the intake lost in the feces, is very striking, particularly of fat and nitrogen.

It seems clear that in these cases of acrodynia, digestion and absorption are of a normal character. The slight tendency to constipation observed does not seem to affect the chemical composition of the stools to the extent of causing any abnormality. More observations are needed to establish anything positively, but these 2 cases show unquestionably an abnormally high urinary excretion of nitrogen in relation to the intake, and in one case, it was accompanied by an excessive loss of bases, which loss also occurred in the urine.

ETIOLOGY.—On seeing our first case we felt reasonably certain that the condition arose probably as a result of some food deficiency. Careful inquiry, however, into the diets of the children observed failed to disclose any gross dietetic errors, certainly not any more than are found in the diet of an average child admitted

TABLE 5.

		C. McF. Acrodynia Age 3 yrs. Wt. 11 Kg.			B. F. Chronic Intestinal Indigestion Age 3 yrs. Wt. 10 Kg.		
Ave. Daily Dried Weight of Feces, Grams		6.77			17.76		
		Fat	Total Nitrogen	Total Salts	Fat	Total Nitrogen	Total Salts
Average Daily Intake	.....Grams	28.669	4.766	7.235	18.477	6.528	11.468
Average Daily Loss in Feces,	Grams	2.270	.276	1.572	4.818	.952	3.854
Percent of Intake Lost in Feces		7.9	5.8	21.7	26.1	14.6	33.6

to a hospital. If food were a prime factor in its etiology, we would certainly expect to find many more cases. In every in-



stance, as far as could be determined, there had been no deficiency in the mother's diet. During the periods of observation the children were fed well balanced diets containing growth elements; it would seem hardly possible that the lowered food intake as a result of anorexia could bring the vitamine content of these diets down to danger point. The exhibition of a normal diet did not influence the progress of the disease.

The question of inadequate food intake as a whole occurs as a possible explanation of the disease. This would serve to explain the low or negative nitrogen balance observed in the 2 cases. One child (C. A.) was receiving about 57 calories per kilogram, the other (C. McF.) about 75 calories per kilogram.

This child showed the more severe clinical symptoms and the more abnormal chemical findings, but apparently had an ample intake, at least at the time of observation. The other child, the infant of 10 months, was receiving barely the normal basal requirement of 60 calories per kilogram. He was not particularly emaciated and could hardly be considered to belong to the malnutrition class with a greatly increased basal metabolism. On the whole, however, he must be considered as underfed at the time of observation, and one might consider the inadequate intake as an explanation, in this case, of the abnormally low nitrogen retention, if it were not for the more extreme nitrogen findings in the case of the other child who did take the requisite amount of food.

The theory of a chronic mildly toxic condition, not severe enough to raise the temperature regularly, would seem in view of the constancy of the clinical symptoms to be more easily acceptable than that of a food deficiency as a suggested explanation of the abnormally increased nitrogen metabolism. The occasional slight rise in temperature, which is characteristic of these cases, lends support to this view. Suggestions as to the cause of the toxic condition are contained in the clinical part of the paper. However, more cases need to be studied, and other lines of investigation undertaken before any definite conclusion can be reached as to the cause of the abnormally high urinary excretion of nitrogen, and in one case of bases, observed in these cases of acrodynia.

DIAGNOSIS.—A case of acrodynia once seen will never be for-

gotten especially when it is a well advanced case. There are instances, however, when the initial rash is somewhat similar to that of scarlet fever. The less extreme cases, where the eruption around the fingers and toes is not seen, may be confusing; but the other skin manifestations, such as sweating, together with the general emaciated and wretched condition of the patient, leave no doubt in one's mind. A careful history and close scrutiny of the nasopharynx will in our opinion reveal either past or present trouble.

#### SUMMARY.

1. In all, 8 cases are reported with 2 deaths from a complicating bronchopneumonia.

2. All cases showed unmistakable evidence of a chronic or sub-acute nasopharyngitis; in 2 instances the infection extended to the lungs and further proof of infection was the existence of a fairly regular polymorphonucleosis, occasional fever and a definite seasonal incidence.

3. In the 2 cases studied from a metabolic standpoint, there was observed a lowered or negative nitrogen balance, and in one a negative balance of bases. The excessive loss of nitrogen and bases occurred through the urine.

4. From a study of this series, food deficiency does not seem to be an adequate explanation of the condition.

5. We believe the condition to be a chronic toxic condition following or coincident with a chronic respiratory infection which brings about the clinical and metabolic changes observed.

**AUTHOR'S NOTE.**—On personal communication with Dr. Bilderback of Portland, Oregon, the authors discovered that his description was the one cited under Patrick's name in Weston's article. We therefore feel that to Dr. Bilderback should be given the credit of first describing this condition in children.

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## THE SPECIFIC TREATMENT OF DIPHTHERIA.\*

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Nearly 30 years have passed since Behring gave to the world his epoch-making discovery, that it was possible to produce in the horse an antitoxin, which, when injected into humans suffering from the disease sufficiently early after its onset, acted as a specific cure.

The immediate effect of antitoxin was spectacular. The mortality of the disease dropped from about 75 per cent. in 1894 to about 10 per cent. in 1904. In spite of specific therapy and what is known concerning the immunity to the disease, there occur in the United States annually about 200,000 cases with 20,000 deaths. The incidence of the disease is to say the least not surprising. Following the work of Schick in 1913 the relative immunity to diphtheria at different ages has been constantly proven. Within individual limits the susceptibility to the disease under 5 years of age is very great. Added to this is the lamentable fact, that up to the present time, the carrier problem has not been controlled. One cannot, however, view with complacency the startling figures relative to mortality. The medical profession has at its disposal a specific cure for a malignant disease and in spite of this well established fact, thousands of children die annually of diphtheria. No paper dealing with the therapy of a disease would be comprehensive did it not contain a careful inquiry to elucidate, if possible, the reasons why specific measures of treatment have not met with uniform success. In discussing this element in the question one is confronted by several pertinent facts. The mortality from diphtheria depends absolutely upon the rapidity with which the diagnosis is established and the promptness with which proper and effective treatment is instituted. If these statements are accepted, an effort must subsequently be made to explain the reasons why diagnoses are not made early and why proper therapeutic measures are not carried out. The

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essential reasons are attributable first, to the laity, and second, to the profession. They are in each instance due to ignorance. The layman should be taught to consider all sore throats diphtheritic until they are proven otherwise. The education of the medical advisor in the communicable diseases should be such, that the presence of an exudate however small, should automatically call for immediate culture. The clinical picture in incipient tonsillar diphtheria may be one, that the most skillful diagnostician cannot differentiate without the aid of the laboratory. Chronic or acute nasal discharges, particularly when bloody in character, are also potentially due to the Klebs-Loeffler bacillus until the causative relationship of other organisms has been established. Progressive aphonia with an aphonic cough coming on acutely, particularly in children under 2 years of age, should be accepted as evidence of a probable diphtheritic infection and treated as such with or without demonstrable bacteriologic evidence. Finally, the positive statement must be made, that the practitioner of medicine, in treating diphtheria must be first and foremost a clinician. When clinical judgment dictates a procedure, carry it out, irrespective of any evidence to the contrary. One of the most reprehensible forms of neglect is that in which the treatment of evident clinical diphtheria is delayed, either because the report on the culture has not been made or having been made and Klebs-Loeffler bacilli not having been found, too much credence is given to the value of the negative bacteriological diagnosis.

Apropos of erroneous bacteriological diagnoses and the lamentable rôle that they often play in improper treatment, too much emphasis cannot be laid on the importance of proper technique in taking cultures. The average child will oppose any effort to introduce an applicator into his throat, so that frequently the suspected area is not touched. It is absolutely necessary that a suitable exposure should be obtained if any satisfaction is to be expected from laboratory reports. For this purpose, when nose cultures are taken, the swab should be introduced well back toward the posterior nares. In obtaining cultures from the throat, the child should have his entire body wrapped in a blanket so that his arms are sufficiently confined. He should be held in the sitting posture on the lap of his nurse, one of whose arms should encircle his thorax and the other, his forehead. Furthermore, the

individual holding the patient should understand that absolute quiet is essential and the greatest kindness consists in using sufficient force to accomplish this purpose. When the exudate is visible on the tonsils, the material for examination should be obtained from the surface of the membrane, particularly in the crypts. If the diphtheritic process has begun on the pharyngeal wall, it will often be necessary to use a bent applicator so that the culture may be made from the upper portion of the nasopharynx. If, while the throat is being examined or as the culture is being made, the child vomits or regurgitates food into the pharynx, it is absurd to continue. Allow the child to rest and repeat the culture taking. In a general way the rule may be made, that culture taking can only be satisfactory when the operator sees exactly what he is doing, and does not dig at the throat, as is only too frequently the custom. It may seem superfluous to comment upon the importance of every clinician having sufficient laboratory experience to determine whether his culture tubes are in suitable condition for the growth of the organisms. The frequent reports from laboratories, however, that no growth has occurred on the blood serum, bear very conclusive witness to the fact, that the culture tubes in question should never have been used. When the serum is dry and has begun to shrink, it should always be discarded. Any element that may be responsible for delay is reprehensible. One other very important and equally serious phase of the situation is that whereby reports on the identity of the bacteria are not made for 24 hours after the cultures are submitted. In a disease where the time element is so important an effort should be made to establish the diagnosis bacteriologically at the end of 12 hours, and occasionally this is even possible in 8 hours.

It seems absurd with nearly 30 years of experience in the use of antitoxin, that a paper dealing with the technique of its application should be justifiable, and yet there is so great a variation in the opinions of those experienced in the management of diphtheria as to the details of properly administering serum, that a further outline based essentially upon the pathology of the disease may be of value. Diphtheria is a classical example of the group of diseases to which the term "toxemia" has been applied. The number of diphtheria bacilli which actually enter the cir-

culatation is so small as to be a negligible factor. Death takes place as a result of the action of the diphtheria toxin on the tissues with the exception of those cases where mechanical obstruction produces asphyxia. In animals of a given weight it is always possible to produce death with a given amount of toxin, which can be accurately measured, and likewise always possible to save life if an amount of antitoxin necessary to neutralize this toxin is injected, provided that the antitoxin is administered before the toxin has already had a lethal action upon the tissues. This general statement, which cannot be contraverted, applies equally well to man. There is, however, a tremendous factor in the human species of which track is frequently lost, and it is ignorance of this factor, which has been responsible for an improper comprehension of the pathology and treatment of diphtheria. In the blood stream of most individuals there is present a certain amount of natural antitoxin. If this is present in an amount equal to or exceeding  $1/30$  of a unit per c.c., as is the case in about 75 per cent. of all adults, irrespective of the number or virulence of the diphtheria bacilli entering the throat, the individual will never develop the disease and will always give a negative Schick reaction. People, who develop the disease, may have varying amounts of natural antitoxin in their blood and some can always be found in whom none is demonstrable. Whereas it has been clearly shown, that the virulence of diphtheria bacilli varies with different strains and that this factor plays a rôle in determining the severity of the infection, this influence is probably very slight. It is entirely a question of the amount of natural antitoxin in the blood. A child with  $1/60$  of a unit per c.c. will resist the toxemia with far greater capacity than one with  $1/120$  of a unit per c.c. and when no natural antitoxin is present, the exposed tissues suffer correspondingly rapidly and severely. Another element must be taken into consideration. It has been definitely shown, that when individuals, who have a natural antitoxin immunity, i. e. an amount of antitoxin in the blood sufficiently large to protect against infection, are injected with even a single dose of toxin-antitoxin mixture, such as is used to confer an active immunity upon susceptibles, that the antitoxin content of their blood rises very rapidly. It is therefore reasonable to infer that infected children, who have a certain amount of natural anti-

toxin in their blood, will, following infection, increase this much more quickly than those in whom no antitoxin is naturally present. It is perfectly logical to assume that those children, having the largest amounts of natural antitoxin in their blood streams, will run the mildest course, but unfortunately at the present time there is no rapid method whereby an estimation of this is possible, so that it should play no great rôle in modifying treatment. Too much stress cannot be laid upon the following generalization. Medical advisors, whose patients recover when the administration of the antitoxin is delayed and the dose too small, should not delude themselves as to their efficiency. The natural antitoxin in the blood stream of the sick child has only too often protected the patient against the ignorance of a poor practitioner.

That the action of diphtheria toxin on the tissues of unprotected individuals is extraordinarily rapid, and when fixed to the cells, its harmful results irreparable have been proven many times by clinical observation. Anyone of experience must remember the unfortunate case seen at the end of 24 hours' illness, with all of the symptoms of a fulminating diphtheria, who, in spite of receiving a tremendous dose of antitoxin by the intravenous route, dies on the 3rd or 4th day from the destructive action of the toxin on the heart muscle. Equally distressing and illustrating the same deadly effect of the fixation of the toxin to the tissue cells is the case in which toxin is not administered until what is apparently not a very clinical diphtheria has lasted several days. Following the treatment, immediate amelioration occurs in the symptoms and recovery seems certain, when at the end of the 2nd, 3rd or 4th week sudden death takes place with every evidence of an acute heart block. Add to these lamentable types of cases the innumerable instances of paralyses illustrating the action of the diphtheria toxin on nerve tissue, and one would think that very little argument would be necessary to impress upon the clinician the importance of early treatment.

The Schick test is an excellent experimental example of the action of diphtheria toxin on the tissues. Park and Zingher availed themselves of this in studying the effectiveness of antitoxin when administered by the different routes. The experiments are so classical and at the same time so simple, that one can do no better than quote them exactly in an effort to prove

his arguments as to the treatment of diphtheria based on its pathology. (See chart.)

RELATIVE EFFICIENCY OF DIPHTHERIA ANTITOXIN ADMINISTERED IN DIFFERENT WAYS.

Age	Units	Mode of Administration	Schick 20 hours previously	Schick 6 hours previously	Schick 4 hours previously	Schick 2 hours previously	Simultaneously	2 hours subsequently
6	1000	Subcutan.		+++	+++	++	±	—
4	1000	Intramusc.		+++	+++	—	—	—
5	1000	Intraven.		+	±		—	—
5	20000	Subcutan.		±	±			—
6	10000	Intraven.	++					—
6	10000	Intramusc.	+++					
6	10000	Subcutan.	+++					

When the toxin has acted on the tissues for 24 hours, 10,000 units of antitoxin intravenously have very little potency in neutralizing the toxin sufficiently to prevent its effect on the cells as evidenced by the inflammatory reaction of the positive Schick test. When 10,000 units are administered by the intramuscular or subcutaneous routes, they are absolutely ineffectual in preventing a positive reaction. When the cutaneous tissues are exposed to the diphtheria toxin for only 6 hours, it requires 1,000 units intravenously to prevent toxin fixation. The same amount of antitoxin by the intramuscular or subcutaneous method is not effective. Twenty thousand units of antitoxin subcutaneously are necessary to produce the same effect in preventing the development of a positive Schick reaction, as is achieved by 1,000 units intravenously. It would seem as if very little further argument were necessary to prove the statement, that the prognosis in any case of diphtheria depends upon the rapidity with which antitoxin can be made available to the tissues.

Park has called attention as further argument in favor of the intravenous method of therapy, that antitoxin passes into the tissue fluids from the blood ten times as fast when given directly into a vein as when given under the skin and four times as fast as when given into a muscle. Examination of the blood for antitoxin content has furthermore revealed that when the serum is injected under the skin, the major portion of the antitoxin is not absorbed into the blood stream for 24 hours and when the serum is injected into a muscle, the major portion of the antitoxin is not taken up by the blood for 12 hours. The swelling occasioned by the injection disappears very rapidly, but incidental



to this only the water is absorbed. The colloid portions of the serum in which the antitoxin is contained are taken up much more slowly.

Granting first, that the successful treatment of diphtheria depends upon the early diagnosis and then upon the rapidity with which the antitoxin can be made available to the tissues, and granting second, that this can best be accomplished by the intravenous route, one must carefully survey any possible disadvantages that may be present incidental to intravenous therapy. The unpleasant and very rarely disastrous results that may follow the injection of antitoxin into a vein may be divided into three groups: 1. The exceedingly rare case of status lymphaticus in which sudden death may occur. This type of child will likewise suffer from the shock of administering antitoxin by the intramuscular or subcutaneous method. He is the individual that succumbs to the first whiff of an anesthetic or to a slight accident in which the degree of injury is in no way sufficient to explain death. 2. Cases that manifest symptoms analogous to those shown by animals suffering from anaphylactic shock. This predisposition on the part of a child severely ill of diphtheria is likewise no contra-indication to the use of antitoxin by the intravenous method for the following reason. It has been definitely shown, that by giving these individuals minute doses, 1 c.c. of serum, first subcutaneously and then intramuscularly at hourly intervals, it will be possible to inject antitoxin intravenously beginning in doses as small, if necessary, as 1/100 c.c. and gradually increasing at half hour intervals to 1/10 c.c. and 1 c.c. and finally to the full dose of serum. On account of the clinical rarity of these symptoms in communicable disease hospitals, previous desensitization to antitoxin administration has been largely discarded. It is, however, probably a safer procedure to inquire carefully in all children ill of diphtheria, as to the presence of asthma, particularly the type coming on in the environment of horses, eczema, urticaria, or the previous administration of horse serum, and desensitize accordingly. Recent animal experimentation has shown, that the presence of foreign peptones in the circulation may desensitize and prevent anaphylactic shock in animals, who would be otherwise sensitive to specific proteins. It is, of course, possible that the diphtheria toxin itself helps to

desensitize against the foreign serum. 3. Cases that manifest unpleasant symptoms associated probably with the injection into the circulation of foreign colloids. Mild symptoms of this type are very common. The chill followed by rapid rise in temperature, or high temperature without a chill subsequent to intravenous therapy is probably a part of this symptom complex. Very rarely the symptoms may be much more alarming and remote cases have been reported in which death has ensued. These cases have usually a severe chill which develops gradually into a convulsive state bordering almost on a status epilepticus. Very high temperatures occur and the respiratory and circulatory apparatus are rapidly embarrassed. The color of the child becomes cyanotic, at times gray. Respiration may be very rapid or very slow, but is not associated with asthmatic râles as in anaphylactic shock. Urticaria is not present. The heart action becomes markedly accelerated and weaker and the patient dies of a combined respiratory and circulatory failure. These untoward results have never been satisfactorily explained.

Weighing carefully the argument of these occasionally lamentable results of treatment against the tremendous mortality of improperly treated diphtheria, one must most emphatically reiterate. The successful treatment of diphtheria depends absolutely and unequivocally upon the earliest possible administration of sufficient antitoxin by that method whereby it can be made most readily and most rapidly available to the tissue cells. The weakness of most presentations dealing with therapy consists in the great tendency of such contributions to generalizations. The strength of specificity on the other hand is somewhat marred by the fact that exact directions as to treatment can only be laid down with a full realization, that individual variations in patient and disease may amplify details. In the treatment of diphtheria, accurate directions must take into consideration first, it is always better to give too much than too little antitoxin, and second, if a second dose is given, it is significant that more should have been given at the first administration inasmuch as a second dose is an admission that sufficient was not given at the first injection to neutralize the toxin in the tissues as well as that in the blood. A great many arguments have been presented as to variations in dosage depending on age and weight. There is no argument, of

course, to controvert the fact that a child weighing 100 pounds, with malignant untreated diphtheria, should receive more antitoxin than one weighing 20 pounds. On the other hand, the disease is apt to be much more severe in younger children, in whose blood streams smaller amounts of natural antitoxin are ordinarily present. In advising dosage, two conditions play a far greater rôle than the age and weight of the child, namely, duration of the disease and severity, as evidenced by clinical phenomena. The following single intravenous doses have been sufficient and may be used with expectation of excellent results if administered before tissue fixation and destruction have been too great.

	Early Mild Cases	Early Severe Late Mild Cases	Malignant
Infants under 2 years.....	3,000	5,000	10,000
Older children .....	5,000	10,000	15,000

In giving antitoxin intravenously, 3 very simple rules should be followed. Disagreeable reactions will often be obviated by the following observations: 1. Give antitoxin at a temperature of 37°. 2. Give antitoxin slowly, not faster than 1 c.c. per minute. 3. Endeavor to give a preparation that is absolutely clear.

When the intravenous method cannot be used, from twice the amount in the mild cases to 4 times the amount in the severe cases should be given in a single injection by the intramuscular method. The subcutaneous injection of antitoxin should never be used in the treatment of diphtheria. In view of what is known concerning the action of diphtheria toxin and the absorption of antitoxin, its use by this route is not only contraindicated, it is a distinct menace. The subcutaneous injection of antitoxin should be reserved for those children who have been exposed to the disease, upon whom it is desirable to confer a temporary passive immunity.

For the purpose of concentrating upon the most important phase of the treatment of diphtheria, this paper has been limited simply to a consideration of specific therapy. It may be permissible to add one word on the question of rest. Mild and

early diphtheria cases should be kept in bed 2 weeks. Severe and late ones should be confined to bed from 4 to 8 weeks, depending upon the heart musculature and evidences of nerve involvement. Every clinician should be certain that the innervation of the palate and the eyes is intact before too much liberty is accorded the patient. Loss of knee jerks may be the first and only sign of the fact, that the diphtheria toxin had become fixed to the nerve cells in even a very mild case before the antitoxin had been given.

#### CONCLUSIONS

Three very important rules may be laid down in the specific treatment of diphtheria:

1. Antitoxin should be given at the earliest possible moment.
2. It should be given in a sufficiently large dose in a single injection.
3. The method of administration should be that whereby the antitoxin may be made most quickly available to the tissues.

No case will die if an amount of antitoxin is made available to the tissues at a time sufficiently early to prevent tissue fixation. On the other hand, any case may die, irrespective of the quantity of antitoxin administered, if it is given at a time when the fixation of the toxin in the tissues has already occurred. Mild cases will survive when the above rules are not followed because of the protection afforded by the natural antitoxin in the blood stream. Only by the closest application of the following axiom will the malignant cases be saved: Give antitoxin early. Give antitoxin in a sufficiently large dose. Give it by the intravenous route.

## NUTRITION CLINICS\*

By John B. Manning M.D., Herbert L. Moon M.D., and  
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From the past history of our draft findings during the war period, with the high percentage of men unfit for military duty, and a like percentage in the Student's Army Training Corps, it behooves us to get at the foundation of our future men and women, namely the children, both of school and pre-school age, and to start them in the right direction, that they may become useful future citizens, and fathers and mothers of more normal children.

The malnourished child is a sick child and should be so classed. However, the fact that a child is over or under weight according to a set standard does not absolutely mean that he is malnourished. But the relationship of the individual child's weight and height and any standard table of average weight-height is evidence, although not conclusive proof, of his physical condition, for to it one must add the facts of heredity and environment. The former we cannot change, for the children of weak, sick, or underweight parents are not prone to be normal as compared to an average of thousands of children measured, weighed and charted.

An average to work towards can, however, be established. This has been done after careful measurements and weight records of many thousands of children of varying ages had been recorded and put into average weight-height records for the normal child of a given age.

In the past the weight-age was the basis frequently used in the nutritional measurement, then height-age records were established, both of which were unsatisfactory. These have been superseded by the general physiological equation of weight-height; and this has proved, to date, the most practical working basis for the nutritional measurement of children.

Retan<sup>1</sup> makes the following statement: "The measure of

\*Read before the North Coast Pacific Pediatric Society, Spokane, Wash., January 29, 1921, by Dr. Herbert L. Moon.

nutrition is the best single indicator of a child's state of health. There is no single observation that could be made on a group of children that would lend so much knowledge of their health as a series of weights over a period of time, these to be compared with a normal standard."

*Growth of the Child.*—Children usually follow fairly closely the growth of one or the other of the parents. Infants and young children show a fairly steady increase in growth during the first 6 years. Then comes an active period of skeletal growth; length increasing more rapidly between the sixth and ninth years. Usually there is a slower increase in length and breadth between the ninth and eleventh years, and a greater activity of growth, meaning an active gain in both weight and height, between the tenth and fifteenth or eleventh and sixteenth years; and at this period we may perhaps discover tuberculosis, which may have lain dormant since an infantile infection, and chlorosis in females.

A disproportionate growth of length without proportional gain in weight may be the cause of various of our clinical symptoms, such as anemia, orthostatic albuminuria, headache, abdominal or the so-called growing pains of childhood.

The above, of course, is the average normal for children, from which the individual child may vary, and in which also the season and temperature play their part, for warm climates stimulate growth and early maturity whereas cold climates retard.

*Seasonal Change.*—Mild temperature may stimulate growth and increase in weight, as less fuel is needed for heat; but hot summer weather, plus the normal activity of the child, means a relatively small gain in weight, whereas our mild winter climate, with school hours to keep the child quiet, and the natural tendency of any animal to store up winter fat, results in a gain of weight. Faber<sup>2</sup> states regarding infants in San Francisco, that seasonal variation has no appreciable effect on infants in the Pacific Coast climate. This also holds for older children, for from observations of our clinics here, and from clinics and private practice, we have all noted, *that children on the West Coast tend to run above average weight-height charts as scheduled by Emerson's and the Government's tables.*

*The Malnourished Child.*—Having established the varying

periods of growth in the child, let us next establish what we shall call the malnourished child. With our numerous investigators, Burk, Boas, Baldwin, Holt, Manny, Smedley, and others, having established for us a weight-height normal at various ages let us consider what percentage below normal constitutes malnourishment.

Any arbitrary point may be set as a working basis wherein the relation of weight and height may be compatible with relatively good health and growth. Emerson and Manny<sup>3</sup> for some time considered as much as 10 per cent. underweight a good working basis, but after considering clinical evidence came to the conclusion that 7 per cent. underweight was the most satisfactory dividing line. For the fat or overweight child 20 per cent. above normal was considered the dividing line of the normal from the obese, for they found that often children did much better at 10 per cent. above normal than at the normal weight-height record.

Recently Retan, Faber and others have shown a tendency to run nutrition zones rather than an average normal line. However, for the sake of comparison and percentages we will follow the present Government table. Thus using the Government chart for the weight-height ratio as a standard, we can select the large group of malnourished children which need attention and then depend on individual diagnosis from the physical examination to identify those cases not included by the chart system. All cases that are found to be below the normal weight-height record for their age may also receive special attention. Emerson<sup>4</sup> has found that from 20 to 40 per cent. of the children of school or pre-school age are habitually underweight for their height.

*Diagnosis of Malnutrition.*—The clinical history is important as well as the history of the parents and the environment. History of illness is important. Overfatigue, faulty feeding, or other bad health habits may be a cause. The common physical signs are, weight-height ratio of 7 per cent. or more underweight, lines under eyes, fatigue, bad posture, pallor, adenoid facies, mouth breathing or other signs of nasopharyngeal obstruction. Anterior cervical glands are apt to be enlarged and muscles flabby. There may be visceroptosis, flat chest, rigid spine, pot-belly, or other signs of rickets, and flat feet. Nervous symptoms may be

manifest, as irritability, early fatigue on effort, and lack of both physical and mental control.

Gordon and Bartley<sup>5</sup>, studying a series of 900 cases under 8 years, from poor home surroundings, found a relative high per cent. of malnutrition. They conclude that the most critical period in the child's early life is between the ages of 2 and 6 years. They found that the common causes of malnutrition were adenoids and tonsils, defective teeth, gastroenteritis and heart lesions, in the order named. They maintain that the degree of nutrition present should be judged by one or more standards, not just weight-height alone.

*Tabulated Results in 3 Nutrition Clinics.*—The summary of our records is as follows:

*Rainier Valley Clinic:* 68 cases of 190 studied.

Adenoids and tonsils.....	24	Scoliosis .....	4
Empyema .....	1	Lordosis .....	1
Enlarged thyroid (9 physi- ological, 9 pathological)...	18	Mongolian idiocy .....	1
Chest deformity .....	2	Otitis media .....	2
Tuberculosis (5 suspicious), active .....	4	Ichthyosis .....	1
Lues .....	1	Dental caries .....	5
Rickets .....	6	Acute bronchitis .....	2
Umbilical hernia .....	1	Constipation .....	6
Pediculosis corporis .....	1	Obesity .....	2
Defective hearing .....	1	Tinea circinata .....	1
Mitral disease .....	4	Pleurisy .....	1
		Congen. disloc. hip .....	1

*Weller Street Clinic:* 34 cases of 88 studied.

Tonsils and adenoids .....	21	Rickets .....	1
Enlarged cervical glands....	11	Pulmonary tuberculosis ....	1
Enlarged thyroid .....	3	Chronic appendicitis .....	1
Dental caries .....	12	Tonsillectomy (52.3 per cent.) .....	11
Mentally deficient .....	4		
D'Espine sign positive .....	7		



*South Seattle Clinic:* 28 cases of 100 studied.

Tonsils and adenoids .....	14	Tonsillectomy (28.5 per	
Adherent foreskin .....	3	cent.) .....	4
Acute nephritis .....	1	Circumcised .....	1
Dental caries .....	13	Under treatment .....	1
Rickets .....	1	Under dental care .....	1
Bronchial gland T. B.....	1		

	Rainier	Weller	So. Seattle
Total number of children weighed .....	190	88	100
Total number of children attending regularly	108	42	65
Av. number weeks attendance per child			
(First weighing not included) .....	10	20	10
Average attendance per class .....	45	25	25
Average initial gain .....	348	137	160 lbs.
Average normal gain for 108 children....	179		lbs.
Average normal gain for 42 children ....		65	lbs.
Average normal gain for 65 children....			67 lbs.
Per cent. gain at Rainier Clinic.....			233%
Per cent. gain at Weller Street .....			233%
Per cent. gain at South Seattle .....			260%
Average gain per child, per month.....	1.3	1.3	1.6 lbs.
Average gain per normal child per month =	$\frac{1}{2}$ lb. = 100%.		

Our findings in the 3 Seattle clinics in regard to malnutrition made us wish to carry our work further to its logical conclusion, namely, what is our percentage of malnutrition in the public schools? To do this the pupils of 3 schools were examined for purposes of comparison. The summary is as follows:

School No. 1 .....	53% over 1 lb. underweight
782 pupils show .....	20% over 10% underweight
School No. 2.....	49% over 1 lb. underweight
688 pupils show .....	17½% over 10% underweight
School No. 3 .....	53% over 1 lb. underweight
265 pupils show .....	15% over 10% underweight
Total of 1715 pupils show an average of	17½% underweight.

We have demonstrated by the above figures that in our public schools we have a large percentage of malnutrition and that these

percentages as a whole correspond with the findings of other nutrition clinics throughout the country so far reported.

We see from our work and the statistics quoted above that a big part of the work is educational and need not take up any great part of a physician's time, but it is probably better that the work should be done by a pediatrician. For the educational part of the work a dietitian is necessary to work out the feeding properly in special cases. A trained nurse, while most helpful, is not absolutely necessary for anyone with a small amount of training in general hygiene, and who can apply common sense methods in correcting conditions in the home, can gain the confidence of the family and teach how best to care for the needs of the children.

Three nutrition Clinics have been established in Seattle by the Anti-tuberculosis League of King County under the direction of Miss Reid. We wish to extend credit and thanks to Miss Reid as director, Miss Murchison as dietitian and also to the volunteer students of the University of Washington, who in the field work in sociology have helped us in our work from which we were able to derive material for this paper.

#### SUMMARY.

1. Our children of school and pre-school age show about the same percentage of undernourishment, that is about 20 per cent., as has been found by other observers.
2. Malnutrition may not be suspected with the child clothed, nor can it be accurately diagnosed by superficial inspection. The undressed child with a complete physical examination and a height-weight chart are necessary to make the diagnosis.
3. Children with remedial physical defects are referred to various city clinics for correction before or while starting on their nutrition classes.
4. Besides medical examination, talks and demonstrations should be given in regard to the selection and the preparation of food, personal hygiene, care of teeth and contagious diseases.
5. The Government height-weight chart, with Emerson's "Form for History and Physical Examination," is being used.
6. A 7 per cent. underweight child is arbitrarily considered as malnourished although all children are to be brought up to

the normal weight where possible. "Every child at or above his normal weight line" should be the clinic motto.

7. In our clinics the subject of goitre should receive some extra study.

8. Malnutrition is only in small part due to poverty and disease, but in large part to improper feeding, faulty health habits and faulty hygiene.

9. Faulty health habits are a big factor in malnutrition and a subject for education of both parents and children. Along with this, personal hygiene and good health habits can be taught by anyone with personal knowledge and a keen interest in both the subject and the pupil.

10. In cases which do not respond to class methods, re-examination and special measures for the individual are necessary.

11. The class method of treating malnutrition is practicable. The children by group-distinction take more interest than as individuals. They like to compete with one another as in a game.

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CHLOROMA IN CHILDREN (Pediatria, Naples, July 1, 1920). E. Mensi reports the details of three cases in children, 21 months and 4 years old, and tabulates from the literature 46 cases in children from 1 to 14. Lehdorff states that 50 per cent. of cases of chloroma are in children. The records show that the children are usually otherwise healthy, with normal parents. No connection with trauma has been discovered. Chloroma is a systemic disease which evidently belongs in the group of leukemias, and may reproduce any one of six different types of leukemia. He concludes his long study of the subject by reiterating that the etiology is still a mystery, the prognosis grave, and all treatment ineffecutal. —*Journal A. M. A.*

## BLOOD TRANSFUSION AS A THERAPEUTIC AGENT IN PEDIATRICS.\*

By HOWARD SPOHN, M.B.

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The startling and in many cases almost miraculous results which have followed blood transfusion for hemorrhage and hemolytic diseases have led to the employment of this therapeutic agent in many conditions. An index of the absolutely definite indications for transfusion is still in the making and the benefit of transfusion as a therapeutic agent has not yet become definitely established in all conditions in which its use has been employed.

The observation of the use of this agent in a variety of conditions has aroused a desire to reach some definite conclusions in regard to the conditions in which one may consistently hope to obtain uniform results by its use. In this paper I will give results of some observations made during the last 3 years. The number of cases in different instances has not been sufficiently large to warrant definite conclusions being formed, and this paper is written with the object of obtaining from the members of your association additional knowledge on a very interesting subject.

Blood transfusion is not a recent therapeutic procedure, but dates back to 1667 when Denys published a successful report of cases in which man had been transfused with the blood from lambs and calves. Blundell, in 1818, was apparently one of the first to employ transfusion on a large scale, and reported 4 cases, 2 of which were successful and 2 fatal. The largest amount of blood used was 480 c.c. Karsner,<sup>1</sup> in a recent article notes "that Hasse reported reactions following transfusion and describes the resulting symptoms of fever, rigors, suppression of urine, hematuria, etc. Ponfick, in 1875, also reported lesions of the kidneys in fatal cases, and Hayem, in 1889, reports fatal cases in which emboli and infarcts were found at autopsy." Over 50 years ago transfusion was employed in leukemia, hemorrhage, carbon monoxide poisoning and eclampsia<sup>2</sup>. Within recent years Carrel

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established end-to-end anastomosis of vessels and introduced the first safe method of transfusion, as this method transmitted blood from donor to recipient without the accompanying risk of coagulation. The weakness of this method was that it was impossible to accurately measure the amount of blood transfused. Crile, Elsberg, Kimpton and others improved and simplified the technique of this operation by the use of certain cannulas. In 1906, Crile reported successful transfusion of blood from normal to diseased human beings. At this time Hektoen<sup>3</sup> suggested "the occurrence of iso-agglutinins in human blood and concluded that under special conditions homologous transfusion might prove dangerous by leading to erythrocytic agglutination within the vessels of the subject transfused." A multitude of transfusions have been performed in a great variety of diseased conditions, and cases of incompatibility have been fairly frequently reported. Schultz and Hopkins, in 1910, and Ottenberg, in 1911, reported cases of cross agglutination.

Incompatibility is the chief danger of transfusion and depends on the action of the recipient's serum on the donor's corpuscles, that is, it is necessary to select a donor from a group whose corpuscles are compatible with recipient's serum. There are many methods of making an agglutination test, and they all consist of mixing cells with serum. This is true either with the direct method of testing one blood against the other or the testing of unknown cells with sera of known groups. The division of individuals into different groups was suggested by Landsteiner in 1900.

The direct testing of one blood against the other, can, in an emergency, be quickly carried out by testing 2 loopfuls of the recipient's serum with one loopful of the donor's corpuscles, or a one per cent. solution of red cells is made without washing, by mixing 4 drops of blood in one c.c. of a one per cent. sodium citrate solution. A drop of serum is mixed on a slide with 1 or 2 drops of cell suspension and this is examined under a microscope. Agglutination occurs usually in a few minutes and will show grossly by the appearance of brick dust particles. A microscopic examination should always be made and 30 minutes allowed to elapse before the report is made.

There are a variety of grouping methods in practice, but the

Moss method of grouping is usually found most convenient and accurate; stock sera of groups 2 and 3 being kept to test the unknown blood.

The grouping of blood is important in infants as well as in adults. In the past it was considered practically safe to use a mother as the donor, but agglutination has taken place in several instances where the mother's blood had been used without previous test. For several years the maternal blood was used without test in all cases of transfusion at the Hospital for Sick Children, Toronto. Among a large series with maternal donors one fatal case of agglutination occurred in this service.

In a large number of cases the parent and child will be found in different groups. Unger<sup>4</sup>, in a recent article, stated "that 7 out of 21, or 33 per cent., in a series of mothers and children, were in different groups." In his article Unger draws attention to the fact that "Holban, in 1900, pointed out the difference between the blood of the mother and her infant. He found the agglutinating power of the mother's serum far greater than that of blood taken from the umbilical cord of her infant. About 13 per cent. only of infants contain agglutinins—the average for the adult being 97 per cent. There is also a difference in the cells—the cells of most children possess no receptors, that is, they are not agglutinated by any serum. The cells of about 25 per cent. of new born infants can be agglutinated—in adults the average is 50 per cent. Infants acquire receptors at about 6 months of age. In some cases receptors are acquired before agglutinins." The above facts furnish foundation for the statement that infants do not properly conform to definite groups. Unger stated that practically all children have acquired their adult group at 4 years of age and states that the cells of most children under 6 months cannot be agglutinated and their serum cannot agglutinate a donor's cells, therefore almost any donor can be used in a pinch under 6 months. After some agglutinin reactions occurring in adults where donor and recipient belonged to the same groups, Unger came to the conclusion, after a series of experiments, that these reactions were due to the presence of para or minor agglutinins. He demonstrated a major agglutinin and minor agglutinins in each group and now considers that grouping is not sufficient, and in order to eliminate reactions where donor and recipient

belong to the same group, the one blood should be tested directly against the other; grouping to be done as an added caution.

Today two well established methods survive:

1. The direct or syringe cannula method of Ziemson as improved by Lindeman.<sup>5</sup>
2. The citrate method of Lewisohn.<sup>6</sup>

The choice of methods, especially in pediatrics, is important. Personally, my observations have been made chiefly on cases in which the direct method has been employed, because after a trial of both methods in the Hospital for Sick Children, Toronto, a preference was given to the direct method. Before making a choice of methods one should consider the chief causes for reactions in blood transfusion. They are (1) hemolysis and agglutination; (2) toxic substances developed in blood remaining outside the body; (3) chemicals such as anti-coagulants; (4) sensitization and anaphylaxis. Drinker and Brittingham<sup>7</sup> decreased the number of chills with citrated blood transfusion by removing the platelets from the citrated blood and produced reactions by injecting isolated platelets. The conclusion reached was that citration produced some change in the platelets and this change is partially responsible for chills. They also showed that the citration of blood suspension increased susceptibility to chills.

Novy and DeKruif<sup>8</sup> have shown that toxic substances develop in blood standing outside of the body for 3 minutes. The larger the amount of blood the greater the amount of toxins. In considering this possibility we should recognize the fact that in the direct method the blood is out of the donor and into the recipient in less time than the same amount of blood could be mixed with the citrated solution.

Lindeman<sup>9</sup> points out that the introduction of these toxic substances may produce sensitization, which may produce bronchospasm and angio-neurotic edema in subsequent transfusion. He quotes 2 cases of angio-neurotic edema occurring where citrated transfusion had been previously performed and knows of no similar occurrence with the direct method.

The frequency of reactions varies considerably according to different authorities. Up to June of last year, on the service of the Nursery and Child's Hospital, New York, 350 injections of citrated blood had been given in the superior longitudinal sinus,

without excessive reactions. At the Hospital for Sick Children, Toronto, over 600 direct transfusions were given with a single fatal case in which agglutination occurred. I have not yet secured the percentages of chills in the latter series, but I know that chill was an exceedingly rare occurrence.

Unger,<sup>10</sup> in stating his preference for the unmodified blood, emphasized the fact that clinical reactions are more frequent when the citrated method is employed. Drinker and Brittingham state that with the citrated method febrile reactions occur in 60 per cent. of cases, and a chill in 57 per cent. Unger, with the unmodified method, noted the febrile reactions in 10 per cent. and a chill in 3 per cent. of cases and attributes the difference to an abnormal condition of blood platelets and red cells in citrated blood.

Pemberton<sup>11</sup> of the Mayo Clinic, in reporting 1036 cases with the citrated method, noted 219 or 21 per cent. of reactions in this series. Lewisohn found reactions in 20 per cent. of his cases and considered that the frequency of chills is about the same with the citrated method as with the direct method.

The Mayo Clinic employ the citrated method and lay great stress on the proper preparation of all rubber tubing used. The tubing is first boiled and then treated for 48 hours with a 15 per cent. sodium-hydroxide solution. Water is then run through the tubing for several days. They also emphasize the necessity of chemically pure sodium citrate and the use of fresh doubly distilled water in making this solution. They use the following proportions in transfusion: sodium citrate, grains, 18; water, 60 c.c.; blood 460 c.c.; that is, a 1.5 per cent. sodium citrate mixture. It usually takes about 10 minutes to transfuse 500 c.c. of blood. Just before obtaining the blood, sodium citrate solution is run through tubing and needles, and the beaker is also washed out with sodium citrate solution. With this improved technique, Black is obtaining fewer chills than in the series reported by Pemberton of the same clinic. The usual amount given is 500 c.c. This smaller amount probably accounts for some of the reduction in the number of chills.

Lindeman<sup>9</sup> states that any method should embody the following requisites:



1. Blood must be out of the body in a minimum length of time.
2. It must pass through a minimum amount of foreign material.
3. Anti-coagulants must be avoided if possible.
4. Any foreign material (not even psychological salt solution should be introduced). (Clowes calls attention to the similarity between Na.Ce. and sodium citrate in their general effects on protoplasm.)
5. It must be applicable in any case and in any disease.
6. It must be possible to transfuse in any amount with a minimum reaction.

The direct method certainly seems to meet these requirements better than the citrated method.

A slightly modified Lindeman method is the one in use at the Hospital for Sick Children, Toronto. The instruments used are six 20 c.c. Luer glass syringes, a vein needle of the trochar-cannula type, several Luer needles with unbevelled tips, 2 short rubber tubes to connect needles and syringes, a fine pair of scissors, a set of small dissecting instruments and 1 or 2 small artery forceps.

The usual surgical preparation of instruments is observed and syringes, tubes and needles are lubricated by drawing through them sterilized liquid paraffin.

It is usually necessary to cut down and expose the recipient's vein in infants and children. One of the elbow veins or the internal saphenous are usually selected. After sterilization of the skin, local anesthesia is produced by the injection of 1.5 per cent. novocaine or a 1 per cent. apothesine solution.

A tourniquet is used to distend the vein and after exposure the vein is tied at the distal end and the tourniquet is released. A small oblique opening is made in the vein with the scissors and an unbevelled needle introduced and tied into the vein. As soon as the needle fills with blood a syringe filled with saline is attached and a small amount of saline slowly introduced to clear the needle of blood. As soon as the assistant has secured a 20 c.c. syringe full of the donor's blood, the saline syringe is disconnected from the needle and the donor's blood is injected into

the recipient's vein. A small amount of saline solution is injected as soon as the blood has been given in order to keep the tube and needle free and another syringe of blood is then injected; the operation being repeated until the required amount of blood has been given. From 20 to 30 seconds is the usual time taken to introduce 20 c.c. of blood; 100 c.c. in 3 minutes is the rate of injection. A free supply of blood from the donor is assured by clearing the needle in the vein from time to time with saline.

The amount of blood transfused is important and an estimate of the blood volume of the patient should be considered. In this regard Lucas and Dearing<sup>12</sup> have just published an article showing that the blood volume in infants varies considerably, but places the average at 14.7 per cent. of body weight—147 c.c. per kilogram. The amount to be given varies according to the condition for which it is given, the result to be achieved and the physical condition of the patient. Unger, in 1919, advised as the usual dose for infants 80 to 150 c.c. A safe limit is to give up to 15 c.c. per pound of body weight. In mild cases of hemorrhage a much smaller dose will often be sufficient. Experimentally, an animal cannot always survive a loss of half its blood volume, so that it may be assumed that an exsanguinated infant has lost from  $\frac{1}{4}$  to  $\frac{1}{2}$  its blood volume.

The danger of hyper-transfusion in infants needs careful consideration. The symptoms of an overdose are cough, increased respiration, quick thready pulse. In older patients, pre-cordial pain, backache and pain in the legs are complained of. Cough may be regarded as one of the first danger signals and the transfusion should be stopped as soon as this symptom appears.

The symptoms of iso-hemolytic reactions occur while the transfusion is in progress or directly after it. The patient becomes restless, there is increased respiration and pulse and at times cyanosis, and adult patients complain of severe pain in the lumbar region; nausea and vomiting may occur. There is a sharp rise of temperature to 104° or more, and this is usually followed by a severe chill. The patient appears shocked and may become unconscious—later hemoglobinuria, with suppression of urine follows and later on jaundice. The severity of the reaction is usually over in 24 hours, and of course at many times reactions are much milder than those described; at times they are de-

layed in their onset, sometimes not appearing for 18 hours. Recovery is more general than a fatal termination.

Transfusion exerts influences in different ways—(1) it replenishes a depleted circulation (unlike saline injections it maintains an increased blood volume), by producing an increased blood volume with a decreased rate of blood flow and there follows a diminution of the rate of pulse respiration, and a rise in blood pressure; (2) it replaces lost corpuscles, that is, it replaces tissue. Ashby<sup>13</sup> in her work has shown that 80 to 60 per cent. of the transfused corpuscles may remain in the circulation for 26 to 35 days; (3) it stimulates blood production, that is, it increases marrow activity; (4) it tends to reduce fever in cases where this has been present previous to transfusion; (5) if basal metabolism has been high it tends to diminish it (Brittingham and Drinker); (6) it promotes general improvement of health, as seen in increase of appetite, relief of restlessness, decrease in headaches, etc. The blood picture after transfusion often depends on the form of the disease present. There is a general tendency to make the blood forming tissues act in a normal fashion, therefore if benefit is received there is a more or less marked tendency for the blood picture to become more normal. There is usually an increase in hemoglobin percentage (up to 15 per cent.) and usually an increase in the red count.

The following are some of the conditions in which transfusion is indicated:—(1) *Hemorrhage*.—The relief of simple hemorrhage and hemorrhage of the new-born is usually so effectual and so well established that it needs very little emphasis. From 85 to 90 per cent. of cases of acute hemorrhage are relieved by one transfusion. Relief is usually obtained by transfusing a quantity considerably less than that which has been lost, as the body can replace the loss of fluid with considerable rapidity. Karsner points out that transfusion probably exerts influences in the following ways: (a) on the circulatory balance, (b) on metabolism, (c) on the production of erythrocytes. While we get good results from subcutaneous or intra-muscular injections of whole blood or horse serum, one must bear in mind that besides stopping the bleeding the lost corpuscles must be replaced. In early and slight cases of hemorrhage of the new-born from 30 to 50 c.c. is usually sufficient to arrest hemorrhage. The blood has many

times been injected in the longitudinal sinus. I have employed this method successfully a number of times, but must confess that I do not think it as safe a procedure as the use of one of the other veins. Even with a block needle, such as the Gold-bloom or Ratner sinus needles, there is some danger of getting outside the sinus and causing a cerebral hemorrhage. In injecting blood into the blood stream it is sometimes difficult, owing to similarity of color of the fluids, to know definitely that the needle is in the proper channel. With clear solutions, such as glucose or saline, one can from time to time, during the injection, draw the blood back into the syringe and in this way make sure the needle is in the vein. Some recent x-ray plates following longitudinal sinus injections show that hemorrhage has followed some apparently safe injections.

(2) *Hemophilia-transfusion* is a specific for the bleeding, but unfortunately does not cure the hereditary abnormality of the blood and blood forming organs. In these cases it is wise not to temporize with other measures, but transfuse immediately. It is a measure which not only controls the hemorrhage but replaces the lost blood. ,

(3) *Purpura-hemorrhagica*.—This condition is due to platelet deficiency. Transfusion controls the hemorrhage by introducing new platelets. This is effectual so long as the platelets last. Repeated transfusions are necessary to bring about general improvement. As a permanent cure transfusion has been rather disappointing.

(4) *Pernicious or primary anemia*.—Repeated transfusions lengthen the interval between remissions and produces temporary benefit only.

(5) *Secondary anemia*.—The results are frequently marvelous. A great deal of course, depends on the removal of the initial cause, as, for example, relieving anemia following pyelitis. One must, of course, eradicate the invading organism to insure permanent benefit.

(6) *Leukemia*.—Even repeated transfusions exert at best only temporary relief.

(7) *Pseudo-leukemia or von Jaksch's anemia*.—The results are often extremely good. In acute anemias, transfusion produces an increase in the red cells and the hemoglobin percentage

—the transfusion apparently acting as a stimulus to blood formation. In chronic anemias, over-transfusion may act as a depressant to the blood forming organs and in such cases frequent small transfusions are usually more beneficial than a single large transfusion.

(8) *Shock*.—Transfusion is the most valuable therapeutic agent in this condition. In shock following hemorrhage it is, of course, the only rational treatment. In purely surgical shock it is apparently somewhat more effectual than 6 per cent. acacia gum solution. Like acacia gum solution it has the advantage over saline solution of remaining in the circulation and thus maintaining volume. There are many conditions connected with the production of shock and transfusion is only one of various means employed to meet a very complex situation. At the Hospital for Sick Children, Toronto, over a period of 2½ years, all cases of pyloric stenosis have been transfused at the time of operation—the elimination of shock has apparently been marked.

The above conditions are those in which benefit from transfusion is definite. The following conditions are those in which there is at least some element of doubt as to its efficacy:—

(1) In some cases of infections it has been of apparently marked benefit, but this field offers opportunity for future study.

In general infections, such as congenital syphilis, it can be used as a general supportive measure, but I have never observed any prolonged benefit resulting in these cases; the same is true of tubercular cases.

In chronic pyogenic infections, good results have been claimed in adult cases. In a small series of cases of furunculosis in which the citrated method was employed, no uniformly beneficial results were obtained and no definite conclusions could be reached. In infections the use of the blood of donors who have been immunized against the infecting organism has been advised. In this way corpuscles united with immune substances to fight invading organisms would be introduced. This treatment opens up the question as to whether hyper-susceptibility, such as exists in asthma and hay-fever, could not be transferred to the recipient. A few such cases have been reported. In acute infections, transfusion has not been proved of definite value.

In a series of 6 cases of acute bronchopneumonia no beneficial result could be attributed to transfusion. As one of the dangers of hyper-transfusion is edema of the lungs, would ~~one~~ not be justified in advising against this procedure in acute pulmonary infections?

(2) Transfusion has been used in nutritional cases, such as malnutrition and decomposition. I have never seen uniform results, but occasionally one meets with marked improvement. In a small series of malnutrition and prematurity, and a small series of decomposition cases, the results were not such that one could attribute any permanent improvement to transfusion. A few years ago Freeman was greatly encouraged with the apparently good results obtained by subcutaneous injections of whole blood or horse serum in a series of malnutrition cases. Subsequent results from the latter series did not, however, produce similar results. Up to the present time transfusion cannot be regarded as a definite therapeutic agent in nutritional cases, although benefit occurs in these cases when associated with secondary anemia.

#### CONCLUSIONS.

1. Infants under 6 months cannot be definitely grouped, but even at this age incompatibility occasionally exists and the blood of the donor and recipient should be tested against each other or grouped.
2. The normal blood volume should be considered and hyper-transfusion should be avoided.
3. The direct method is safe and quick and produces fewer reactions than the citrated method.
4. For simple hemorrhage, the citrated method is usually sufficient.
5. For hemolytic conditions in infants and children the unaltered whole blood is more beneficial.
6. Transfusion is of definite value in the relief of hemorrhage and certain hemolytic conditions. Its value as a proven therapeutic agent in infections and nutritional disorders has yet to be established.

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CENTRIFUGED HUMAN MILK FOR SICK INFANTS (Archiv für Kinderheilkunde, Stuttgart, Oct. 16, 1920). F. Friedberg and C. Noeggerath describe the remarkable improvement of certain very sick infants when fed with breast milk from which the fat had been removed by centrifuging. It may prove a life saving measure in severe cases of "decomposition" as well as ordinary toxicosis. It averts the necessity for a starvation diet for more than one day at most. One 6 months' infant was given the second day 180 c.c. of the separator breast milk, increasing to 240 c.c. and by the fourth day all the symptoms of the toxicosis had subsided. The next day full breast milk was allowed in the same amount and the sixth day the whole picture of the toxicosis returned with cerebral symptoms and fever and persisted for five days, the child only gradually recuperating thereafter under whole breast milk. One infant of 2½ months with severe "decomposition" which had persisted for four days was restricted to tea for six hours, with six enemas of Ringer's solution, each 50 c.c., and analeptics, and then was given the centrifuged breast milk in small amounts, slowly increasing. The weight began to rise by the next day. By the fourth day small amounts of whole breast milk were allowed in addition. By the eighth day this was given exclusively, and the child continued to thrive. Infants thrive on this centrifuged breast milk when their condition seems to prevent their being nourished in any way. The nutritional properties of breast milk are paralyzed by the fat in it in these extremely toxic cases.

—*Journal A. M. A.*

# CERTAIN NON-TECHNICAL CONSIDERATIONS IN THE TREATMENT OF HARE LIP AND CLEFT PALATE\*

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One of the foremost teachers of surgery of the last generation, Dr. Geo. B. de Nancrede, often said to his students, "I am a medical man who operates." The surgeon of his day was too frequently only the skillful technician who was called upon to exercise his especial ability after the medical man had made a most searching physical examination and differential diagnosis, had estimated the patient's resistance, and perhaps had decided the best time for operation. In styling himself a "medical man who operates," Dr. de Nancrede was impressing upon his pupils the paramount importance of the careful diagnostic procedures and observations usually performed by the medical men, and the fact that however spectacular might be the technical performances of surgery, the highest type of surgeon was the one who employed in the study of a surgical case the same careful examination, diagnostic ability and estimation of personal equation that the medical men bestowed upon medical cases.

Thanks to the recent activities of the American College of Surgeons this type of surgeon is more frequently seen than formerly, but we are still justified in paraphrasing Dr. de Nancrede's words, and saying that the man who does children's surgery should be "a pediatricist who operates"; for he should have, in addition to his surgical skill, the eye of the pediatricist, enabling him to estimate properly the general physical condition, and the state of nutrition; or, lacking that ability, he should avail himself frequently of the judgment of a pediatric consultant. Nowhere in the realm of surgery do apparently slight variations from the normal have such important influence upon operative risk or post-operative recovery as in children's surgery; nowhere else is the

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estimation of reserve strength and resistance more important, and nowhere is an unnecessary operation more potent for harm or more absolutely devoid of even psychological benefit than in an infant.

I shall not touch upon the technical side of the operations for the repair of cleft palate and hare lip nor upon the etiology or diagnosis; but rather shall discuss the conditions which affect the surgical risk, the question of time of operation and the post-operative care.

In reviewing the current literature and text-books it is surprising to note the scant attention paid to these questions and the divergence of opinion among those who mention them; and yet how frequently have each of you been asked, "when is the best time to operate upon my baby?"; "do you think he can stand an operation?"; "how can I build him up?"; and how often has the surgeon turned to you for the post-operative feeding, delegating to you the task of restoring to health an infant who has had surgical shock superimposed upon an already existing condition of poor nutrition which could and should have been improved before operation?

The first question to be considered is the most suitable time for operation, and for the condition of hare lip most authorities agree in saying, "the earlier the better." Formerly this was often interpreted as meaning, within the first few days after birth, but the advocates of this extreme view are rapidly disappearing. It is to be remembered that birth is not the beginning of life. The child has been living and developing for 9 months under conditions which are ideal for protection, even temperature and continuous nourishment, and birth is a transition to a world which is a constant succession of strange external and internal stimuli, which the new organism must meet by the most thorough readjustment. Surely we should not, except to save life, add surgical assault to this already strenuous initiation.

The reasons put forth for the immediate repair of hare lip are usually, that the child cannot nurse well enough to maintain nutrition, that the sensibilities of the family are offended by the child's appearance, and that muscular action increases the width of the gap; but these are more than balanced by the fact that the child has not had time to become thoroughly adjusted to its

food and surroundings and that the smaller the parts the greater the technical difficulty of the operation. A period of from 4 to 6 months is usually necessary to accustom the child to its diet, and to develop a state of nutrition sufficiently stable to weather the strain of the operation with its temporary reduction in feeding. During this period, in some cases the child will be able to nurse well, in others it may be necessary to use massage to lengthen a short nipple, or perhaps to use a nipple shield with a flap which will act as an obturator for the cleft palate; in more difficult cases the breasts must be pumped and the child fed with a special hare-lip nipple, a spoon or dropper or even with a stomach tube. Breast milk should of course be used unless there is a very distinct contra-indication.

It is also essential that the hemoglobin be above 80 per cent. and at times this will require the administration of iron; the citrate or one of the organic forms being the most suitable, given either in the feeding or well diluted just before the nursing.

Colds are a most fruitful source of bad operative results and every effort must be made toward preventing their occurrence and to limiting their duration if they should occur. There are some who advocate measures for cleansing the nose and mouth, but such procedures unless performed with the utmost care are apt to prove irritating and it is better to omit them altogether rather than to develop a fertile ground for bacterial growth.

It is undoubtedly true that the action of the facial muscles tends to widen the gap and much may be done to counteract this if the mother be instructed to use massage frequently during the day for a few minutes at a time forcing the cheeks toward each other and thus approximating the edges of the defect. This massage may be supplemented by the use of adhesive strips extending well out on the cheeks, but care must be used that the skin does not become irritated, changing the position of the strips if necessary or even discontinuing them temporarily, or by using them only at night, and by always cleansing the skin with soap and water followed by 70 per cent. alcohol before applying them.

If these measures be followed for 4 or 5 months the child will be in such good condition that he will react quickly after operation and will have abundant reparative power to promote firm union of the wound.

The postoperative care is of extreme importance. The child must be kept quiet for the first 3 days and opiates are usually necessary. Morphine hypodermically is preferable to paregoric on account of the greater accuracy of dosage and certainty of absorption. The dose may be estimated by Young's rule, considering  $1/8$  or even  $1/12$  grain as the adult dose, and diminishing even this if the child is under weight, for it is to be remembered that infants are highly susceptible to morphine. Proctoclysis by the drop method should be started as soon as the child has been returned from the operating room using 5 per cent. of glucose in the normal saline and adding a small amount of chloral hydrate if necessary as the morphine is discontinued. Cuffs of cardboard or some other stiff material should be worn on the arms for 7 to 10 days to keep the hands from the mouth until the wound is well healed.

Feedings should be commenced as soon as the child has recovered sufficiently from the anesthetic, beginning with half strength and changing to full strength at once if the first feeding is retained. Each feeding should be followed by 1 or 2 drams of sterile water. Never, under any circumstances, should the child be allowed to suck, but should always be fed with a spoon or dropper until the lip has healed solidly.

In cases where the hare lip is associated with a complete cleft in the palate the gap in the alveolar process is usually closed at the same time because otherwise the projecting premaxilla renders impossible the satisfactory closure of the lip. It is also an advantage to do this before ossification and dentition have proceeded further.

The closure of the palate is more difficult than the repair of the lip and is accompanied by more marked surgical shock, so all that has been said regarding the development of a state of good resistance and nutrition applies with doubled force. The child should be gaining weight consistently, should be free from any inflammatory condition of the nose, mouth or ears, and should have a high hemoglobin before the operation is even considered. This may require that he be under careful pediatric supervision for several months on a full, varied diet with perhaps the additional aid of cod-liver oil, iron, phosphorus or other similar tonics. Enlarged tonsils, whether septic or not, must be removed because of

the fact that they prevent the approximation of the halves of the soft palate, but adenoids unless heavily infected should be allowed to remain. The presence of adenoid tissue in the nasopharynx has the effect of bringing the posterior pharyngeal wall forward and makes it possible for the shortened soft palate to more nearly reach it after the operation. This is of distinct value in eating and in the training of the speech defect which is always a problem no matter how perfect the physical operative result.

The best time for closing the palate is between the ages of 12 and 18 months. By this time the first difficulties of dentition are past, the general and local resistance has been improved, development has proceeded to an extent that will permit the use of mucoperiosteal flaps, speech habits have not been formed, and if a previous repair of the lip has been done the tension of the facial muscles has usually appreciably narrowed the cleft.

The postoperative care is even more important than that following repair of the lip. The proctoclysis should be started at once and if stimulation is indicated caffeine may be given in addition to the glucose; nourishment and fluid however, are of greater value in preventing and combating surgical shock than the medical stimulants; opiates for the first 3 days should be given in sufficient doses to insure quiet; the child should not be allowed to cry, laugh or attempt to talk; cuffs on the arms are necessary to keep the fingers out of the mouth. The feedings should be begun as soon as there is reasonable assurance that they will be retained, and if nausea persists peptonized milk may be given by bowel 2 or 3 times during the 12 hour period. No milk should be given by mouth for at least 4 days because of its excellent bacterial cultural properties, but meat juices, broths, albumin water, fruit juices and synthetic protein milk should be used frequently in small amounts followed immediately by sterile water, all to be given by spoon or dropper. The urine should be watched for the appearance of acetone, but in most cases the frequent feeding of liquids and the administration of glucose solution by bowel will prevent the development of acidosis. Some authorities recommend that the mouth and nose be washed or swabbed with a mild antiseptic but this is apt to be an unnecessary irritation and the use of sterile water as above mentioned and the maintenance of the most absolute quiet possible will be found to produce equally satisfactory

results. After the fourth or fifth day milk may be given by mouth and the diet increased gradually so that by the ninth or tenth day it is back to normal; the general principle being that the period of diminished nourishment should be cut as short as is consistent with safety.

#### SUMMARY.

1. The treatment of hare lip and cleft palate is essentially surgical, but to obtain the best results the operation must be deferred until the child is in the best possible physical condition and the development of this condition should be directed by a pediatricist with whom the surgeon should consult regarding the most suitable time for operation.

2. The points to be observed in judging the physical condition are, gain in weight, condition of general nutrition, hemoglobin, and presence of local infection.

3. The physical conditions being suitable, the best time for operation upon hare lip is the fifth or sixth month, and upon cleft palate from the twelfth to the eighteenth month.

4. Good postoperative care is of greatest importance in the production of good results, by preventing shock and by reducing the period of diminished nourishment; and to be effective it must be carried out with the most scrupulous attention to detail.

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DIFFUSE ACUTE SCLERODERMA IN CHILDREN (Bulletin Médical, Paris, Dec. 25, 1920). Dubreuilh has compiled 18 cases, including 5 boys and 13 girls, with this sclerodermia. It is usually preceded by a severe upset in the general health, fright or accident. The treatments employed have been very variable but do not seem to have displayed much influence. Thyroid treatment has been given in most of the more recent cases but has not seemed to modify conditions materially. The disease subsides equally completely with or without it. All the cases on record recovered in time, from 4 months to a year with an average of over 7 months' duration.—*Journal A. M. A.*

## COMMON NERVOUS CONDITIONS OF CHILDREN.

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By the common nervous conditions of children, I wish to make clear, that I refer to the type of patient seen from day to day, presenting no definite pathologic lesion as far as one can discern, but that type exhibiting a heterogenous group of symptoms which seem to arise from nowhere in particular, and fall under no special classification, but present that peculiar attitude of nervousness which is difficult to interpret in so many instances. In other words, the type of child who reacts abnormally to any form of stimuli and whose reaction is out of proportion to the exciting cause.

To cover this subject in only a fairly presentable manner, would be an enormous task, because of the wide and branching channels into which one would necessarily divert were he to touch but superficially the nervous conditions of children as we meet them.

Such conditions play an important rôle in infancy and childhood. They are very common during this period, and are frequently more easily demonstrated than in later years. Such disturbances are, to a high degree, subject to suggestive treatment, and, for this reason, are of great importance to those who treat children.

Realizing as we must, that neuroses cause more suffering among the human race than any other ailment, and that perfectly balanced, emotionally stable adults are no longer the rule, the necessity for the early recognition and proper appreciation of the importance of the nervous state of the infant or young child can not be emphasized too much. I feel that a great responsibility lies with the pediatricist in the upbuilding of the future citizen who will be mentally able to fill his proper place in society.

Child life naturally divides itself into 4 epochs, each of which has its distinctive type of nervous condition—infancy, the period of rapid brain growth; childhood, the awakening time of mental

development or preparation; puberty, the period of metamorphosis; and adolescence, the time of entering a new life, when the individual assumes greater responsibilities and is the closing epoch of child life.

Should the nervous disorders go unrecognized through the first epoch, the infant passes "conditioned" into the next period. Adding thereby additional burdens to the new ones he is about to assume in childhood, and so on through the successive grades or epochs, he carries with him his "conditions" or failures until he is overburdened and unable to properly meet the responsibilities of the most important period—the adolescent—with sufficient nerve force and energy to carry him safely into adulthood.

The study of these disorders, in an unembarrassed way, takes us beneath the usual surface findings to a study of the underlying driving forces which are the basis of human activity. We are now less inclined to attribute these conditions to hypothetical intoxications or constitutional inferiority, and our aim is to find the meaning of the disorder and the part it plays in the adaptation of the child to its environment. A better understanding of the complexities of child life will enable us to deal more comprehensively with many conditions which otherwise would be unintelligible.

Donaldson and Sugita have demonstrated that the human cortex attains its maximum thickness in about 15 months, at which time cell multiplication and migration cease. It is probably true, that the inhibiting function of the brain is not at its maximum until this time, while the irritability of the peripheral nerves has reached its maximum long before this. As a result, we have an unbalanced condition for a considerable period of time, which is, no doubt, responsible for many of the peculiar nervous manifestations seen during the period of infancy, the second, and even the third year of the child's life, as is witnessed in the exaggerated manner in which the child reacts to different forms of stimuli, i. e., a high temperature, the eruption of a tooth, errors in diet, or illnesses, which in the normal child would not give rise to any unusual symptoms. In addition to the imbalances existing between the inhibiting function and peripheral irritability, the unstable state of the nervous system also depends to a great extent upon some defect in the ability of the neurones to assimilate and store

up nutrition and force in sufficient quantities, and with sufficient rapidity to carry on normally the duties imposed upon them.

The nervous child, as we observe him, presents as a rule, one of 2 types of what we call temperament, or disposition, or, we may say, manner of reacting, which depends in turn upon the manner in which he perceives or interprets and responds to the incessant pouring of irritant stimuli upon his brain, through the medium of his common and special sense organs; and is characterized either by hypersensitive and exaggerated response to any form of stimuli, either physical or mental, as shown by the increased tendon reflexes, convulsions, tics etc., or, by the opposite manner of reacting, being depressed, melancholy, extremely reserved.

These types are not so clearly defined during the period of infancy, as they are later in childhood. However, during the first year, we have many signs which enable us to judge what is apt to occur in the years to follow. With the infant, we meet disturbances of digestion, fretfulness, convulsions, delayed dentitions and late closing of the fontanel—eczema or other skin disorders—vomiting and disordered stools—disturbed sleep and much crying—wakefulness—precocity or retardation. And as the infant passes on to childhood, we observe symptoms no less pronounced, but of a different nature. There may be disturbed sleep—night terrors—enuresis—somnambulism—disorders of speech, tics, perversities of appetite, shyness—restlessness—hyperactivity, etc. Unless these are corrected, we have them intensified as he advances into puberty and adolescence, at which time they assume more definite organization and are dignified by the name of hysteria or psychasthenia or all may be covered by the broader term “neuroses.”

The nervous child is generally taken to the physician on account of some of the symptoms before mentioned. The mother does not realize that many of his troubles relate back to her own or the father's condition at the time of conception or to the environment into which he is born, and it is hard for her to understand why relief is difficult to obtain.

Her fears are easily allayed by the family physician who too often conveys the idea that the child is not particularly ill, or is just a little nervous and will soon be normal again or “will out-



grow it." This type of child is only too often treated with utmost deference as regards the true nature of his ailment, and under such management, little or no improvement will take place.

Nervous disorders of older children rarely appear suddenly. They are the end results of many contributing factors which have their origin prenatally and postnatally. The great variety of symptoms presented by the mother when she brings her child for examination emphasizes the importance of a most thorough physical and mental examination. Among the most common symptoms I have noted as related by the mother are—"he gets tired so easily," "he has dark rings under his eyes," "his color is so bad," or "I think his heart is bad," "he doesn't eat or sleep well," "he quarrels with other children so much," or, "he must have worms." And a multitude of other symptoms one might name, any one of which might arise from other causes, but which no doubt, more frequently have their true origin within the nervous system.

Important among the causes of the nervous condition of the child is to some extent his inherited lack of mental stability, but much greater is the influence of his environment. The parents are seldom willing to admit their share of responsibility for the difficulties of the child, and in order for them to appreciate the child's difficulties, it is necessary that they honestly face their own shortcomings and better understand their own lives.

We realize that children who are normal do not worry and fret, and when we meet with a child who is continually upset, we know that he is ill or not agreeing with his environment. Other causes for this disturbed state with the child, who is not distinctly ill, are lonesomeness, fatigue, disposition or habit, and it is very essential that all of these conditions be investigated before deciding whether the child is a neurotic or merely the victim of circumstances. If he is the only child in the family, he is too much in association with adults, which for 2 reasons is bad for him. It is conducive to mental development unsuited for his years, and he suffers from lonesomeness both of which are potent factors in causing nervousness. Fatigue no doubt ranks more closely to inheritance as a cause for nervousness than any of the rest of this group. It is brought about by too close confinement as well as by too great indulgence in activity. In the poorly regulated homes, there is little or no attention paid to sleeping or

resting hours. The prevailing idea is to feed him and put him to bed at any time most convenient to suit the desires of the grown-ups. Disposition and habit are more closely associated; habits being more the result of disposition or manner of reacting to environment. A common example is the pampered child who reacts with an emotional outburst if denied or restrained from having or doing whatever he chooses to have or to do.

When the child arrives at the school age, he faces new problems which brings about conditions peculiar to that age, and these conditions bear heavily upon him. The hours of confinement, though comparatively short, act as an exciting cause for uneasiness. The stereotyped methods of teaching by abstract and memory fail to interest him. He readily tires of the schoolroom routine, and improves quickly when allowed the freedom of out-door life. These children are usually anemic, frail-bodied, subject to cardiac disturbances, may have an annoying cough. They are very emotional and become easily terrified, their power of imagination is very great, and they are inclined to fret a great deal.

Fortunately, under proper management, many of these symptoms disappear as the child grows older, and he may, by great tact, be restored to his original state, but farther than this, there is little hope of improvement and it is only through untiring effort that the child can be held in a fairly well balanced mental poise until his brain cells have developed sufficiently to stabilize his powers of judgment.

Nature deals peculiarly with these conditions, but usually attains her ends even though it may appear to us that she is taking a round-about way of doing it. However, we can not stop her or even guide her, and if we are wise we will not interfere. If we attempt to hurry matters with the child, we would have about the same experience with him as we would were we to cut off the tadpole's tail to make a frog of him. We would have a poor frog and a ruined tadpole. So with the child he must have sufficient time to develop, and if, during the period of development his mental faculties are crowded we are doing much that is unwise and productive of great harm; actions and processes normally belonging to childhood should not be crowded into infancy.

A child like any other animal, first perceives things by instinct; this gives rise to a habit, and this habit soon gives rise to

other habits. Thus step by step new instincts and habits are created as fast as the growing brain is capable of taking care of them. The nervous system does not develop equally; the centers governing the cruder parts of the anatomy develop first, and we must safeguard nature by allowing that part of the brain ample time to develop. And later, as development goes on, the higher centers need exercise and great judgment must be used relative to the amount of work necessary to produce a normal development without doing harm.

When the child approaches maturity and his brain cells have become more stabilized, then is the proper time to allow a heavier load which should be applied gradually. Each successive period of development will suggest by the child's interest in affairs the proper time for increasing its burdens. If these stages of development are disregarded, as they are in many of our modern school and home methods, we create an aversion in the mind of the child toward his studies, and he is a failure for this reason. A child should be judged as much from his physical attainments as from his mental attainments. If we were to watch the urine of a nervous child, we would observe at times a great increase in phosphatic elements, which eventually become diminished or entirely absent, suggesting a wasting and final exhaustion of the phosphorous elements so essential to the proper nourishment of the nervous system. From this simple test, we learn that nutrition of the proper kind is one of the first requisites in restoring and maintaining a healthy nervous balance. Second, long hours of rest are necessary to allow for repair and the storing up of energy. These two features alone, if properly applied, will in most instances meet the requirements of the nervous infant. Later on, as the child begins to show mental alertness, it is the parents who need most of the supervision. If they can be made to realize the child is a human being and not a plaything brought into the world for their amusement, much will be accomplished in the way of preserving the child's mental equilibrium.

With the nervous school child, considerable consideration must be given as to how much time should be devoted to mental training, and how much to rest; a mid-position, should be the one of choice. He should receive some instruction, but it must be borne in mind that no strain should be placed upon him, which

is out of proportion to his lessened mental ability or resistance, which is always below that of a normal child.

The present-day method of insisting upon hurried return to school duties after an acute illness can not be too much discouraged; ample time for thorough recovery should be allowed in all instances, and more especially with a nervous child. In the management of this type of ailment, we are forced to realize that we can not alter that portion with which the child was endowed at birth. Therefore, our greatest efforts must be expended upon securing a proper environment. Plant the child in the best soil at our disposal, so his nourishment will be abundant and the most suitable for his needs.

Lack of knowledge on the part of the parents in dealing with the nervous child is a potent cause for increasing rather than abating the condition.

The physician must be the monitor in the home, otherwise it is futile to attempt to secure satisfactory results. No part of the child's physical makeup should be overlooked in the treatment of the nervous disorder. His life should be regulated so that he develops symmetrically; his muscle and bone tissue need as much attention as does his brain tissue. He should be allowed to live as near to nature as possible; removal from the din of city life to the country should be encouraged. Let him get most of his education from things in nature.

The training of the child in the home would be more successful, if the parents thought more of what nature would do for the child and cared less about what the neighbors thought of their children. The instincts and habits of the child should not be suppressed; he should not always have his own way, but it should not be the way of the adult but the way of a child. The habits and manners of childhood might well be compared to embryonic growths which do not immediately assume perfect form, and like the tadpole's tail, they should not be interfered with, as such hampering is a great factor in causing nervousness and tends to intensify it all the more in the already nervous child.

#### SUMMARY.

1. Determine if possible whether the nervous state is inherited or acquired.

2. Correct faulty home and school environment.
3. Supervision of the quality and quantity of food.
4. Allow as much of the child's education to be gained through nature as possible.
5. Discourage any process which tends to too rapid advancement or overcrowding the mental faculties. Encourage symmetrical development and long hours of rest.

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LATENT MASTOIDITIS (Presse Médicale, Paris, Jan. 19, 1921). H. Luc holds that the symptoms commonly given in text-books as signifying mastoiditis are more strictly indications not only of suppuration but also of retention of pus in the mastoid antrum. Where there is no hindrance to the exit of the pus into the tympanic cavity these symptoms need not necessarily appear. Abstention from operation in spite of a definite suspicion of participation of the antrum in middle ear suppuration not only allows the ear discharge to continue indefinitely but also exposes the patient to the danger of infection of the lateral sinus or of the meninges and brain. Whenever, in a case of acute otitis treated from the start by free paracentesis tympani, suppuration persists undiminished beyond the third or at most the fourth week, it is the physician's duty to warn the patient that, while it is not impossible that the discharge might eventually stop of itself, such a result would probably be long delayed, and that in the meantime the patient is exposed to extremely serious complications. On the other hand, prompt opening of the antrum would not only eliminate this danger but also quickly put a stop to the discharge. Where, in spite of the warning, the patient continues to refuse operation, the responsibility of the outcome of the case should be placed wholly upon him. Apart from prolonged persistence of free discharge, another indication of latent mastoiditis is that suggested by Cubet-Barbon: Where, after the drum has been freely opened, thoroughly washed through the meatus, and its fundus carefully dried, a droplet of pus at once reappears at the opening, suppuration in the mastoid antrum is suggested.—*New York Medical Journal*.

## CLINICAL DEPARTMENT

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CASE CONTRIBUTED BY

F. R. MENNE, M.D. AND C. ULYSSES MOORE, M.D.,

Portland, Oregon.

CASE No. 14.\* Hazel Leone, 5 months old, was the first child of healthy parents. The father was 22 years of age and the mother 18, with no history of venereal disease in either case. There had been no miscarriages.

The child, born at full term, after a normal labor of 8 hours duration, weighed  $5\frac{1}{2}$  pounds at birth. Under the care of a hospital association doctor she was breast fed only 3 days because the "milk dried up." She was given modified cow's milk mixture and various proprietary foods. The mother stated that the child had vomited frequently after the third week, but, as she was overweight at 5 months, she may have been overfed from the beginning. Aside from the frequent vomiting she was well until 2 A. M., August 1, 1920. At this hour she began vomiting and repeated this 5 times before the arrival of the family physician at 10:30 A. M. The vomitus had a "foul sickening odor." The previous day she had eaten nothing unusual. The physician ordered one-half teaspoonful of paregoric every 3 hours for 3 doses. The first dose was vomited at once. Six ounces of Dennos Food and milk mixture was then given but it too came up immediately. At 3 P. M., a second dose of paregoric was given and retained. At 4 P. M., 6 ounces of whole milk mixture was given. This remained down for 2 hours and was then vomited with great difficulty. One large tough curd stuck in her throat; she could neither swallow it nor raise it. The mother removed all she could reach with her finger; the child then went to sleep and later vomited some more without waking. She slept most of the night. In the morning another dose of paregoric and 6 ounces of milk were given, both of which were retained. At noon she

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\*Spontaneous Rupture of Esophagus in an Infant.  
From Departments of Pathology and Pediatrics, University of Oregon Medical School.

refused food and soon began "fighting for air" and groaned with every breath.

She was seen in consultation by one of us (Moore) at 7:30 P. M. The baby was well developed, overnourished, skin pale, lips blue, the eyes sunken with dark rings underneath; they were glassy and remained open. The pupils reacted sluggishly to light. She was in condition of severe shock. The fontanel was 2.5 by 3 cms. and depressed. There was no nuchal rigidity but rather a flaccidity of all muscles. There was no subcutaneous emphysema. The heart was normal in area and sound. The lungs were clear except for some crackling râles at the left base posteriorly. The alae nasi moved with respiration. The abdomen was moderately distended but there was no rigidity and no noticeable tenderness. The mucous membranes of the mouth and throat were pale and a whitish frothy vomitus welled up on insertion of a tongue depressor. The reflexes were not elicited. The stools were yellow and rather foul; there had been 19 during the preceding 24 hours. The temperature was 105°; pulse, 140; respiration, 66. Each breath was accompanied with a groan. The vomiting had ceased.

The rapid onset and the severe shock made one feel that a surgical condition was present. The rapid grunting respiration and movement of alae nasi pointed to pneumonia but neither the signs in the lungs nor the findings in the abdomen were sufficient to account for the seriousness of the patient's condition.

The treatment consisted in the giving of 200 c.c. of 5 per cent. glucose in normal salt solution by hypodermoclysis.

The child continued to grow weaker and died at 12:30 A. M.—46 hours after onset of illness and 36 hours after the tough curd became fast in her throat.

The following is an abbreviated account of the salient features of the autopsy by one of us (Menne): *Anatomic Diagnosis*:—Spontaneous rupture of the esophagus; stomach contents in left pleural cavity; local sero-fibrinous pleuritis; acute dilatation of the heart. This is the body of a white female baby about 5 months of age and weighing about 17 pounds. The head appears to be well formed. A few small petechial hemorrhages are seen in the conjunctivae. The lips are purplish. No abnormalities are seen about the mouth or neck. The body is well nourished, well pro-

portioned and well developed. There are no evidences of disease or injury on the outside of the body. When the peritoneal cavity is opened the peritoneum is found to be moist, smooth and glistening. The bowel is moderately voluminous and somewhat watery. There are no evidences of mal-position, mal-development, or disease processes in the peritoneal cavity. When the chest is opened the space occupied by the heart is seen to be slightly increased in size due to the dilatation of the right chambers. The pericardial sac is moist, smooth and glistening and contains a slight increase in the amount of fluid. The lungs are only partially collapsed, the left more markedly than the right. The base of the left lung and a portion of its inner surface is roughened and discolored brownish and in the left pleural cavity there is seen a slightly greenish fluid material that is somewhat mucous in character and contains casein. This proves to be stomach contents which have escaped through a tear in the esophagus. The hole in the esophagus is immediately above the point where it passes through the diaphragm, about 1 cm. from the cardia. The tear is of a linear and ragged character and does not appear to be associated with any inflammatory process. The musculature of the esophagus at this point appears slightly more brownish and thinned than other portions, but the starting point of the rupture cannot be determined because of the diffuse character of the tear. The defect extends over an area of 3 cms. in length. There are no noteworthy changes in the external structures of the heart or the blood vessels or any viscera of the chest. The brain and spinal cord were not examined.

*Addendum.*—Microscopic sections of all the tissues of the body disclose no noteworthy pathological changes except for tearing and bile staining the muscles of the esophagus, early fibrin deposit and bile staining of the left parietal and visceral pleurae near the base, and moderate edema of the lungs.

The literature on spontaneous rupture of the esophagus in man is relatively scant. Not more than 20 cases have been found. It is of interest to note that the earliest case reported is that of Boerhaave<sup>1</sup>, in 1724, occurring in an admiral, aged 50, who died as a result of a transverse tear in the esophagus following self-induced vomiting. Since that time sporadic instances have been reported, but the articles by Fitz<sup>2</sup>, Brosch<sup>3</sup>, Bowles



and Turner<sup>4</sup>, and more recently Roys<sup>5</sup>, and McWeeney<sup>6</sup>, are perhaps the most inclusive.

Most of the instances are concerned with individuals past the third decade of life. The reports of Boyd<sup>7</sup>, dealing with a spontaneous rupture of the esophagus in a child 4 months old, that of Howse<sup>8</sup>, in a child 3 years old and by Guersent<sup>9</sup>, in a child 7 years old constitute the only previous reports of such a lesion in infancy and childhood in a period of 200 years.

The causes of rupture of the esophagus have been largely a matter of conjecture. The question of spontaneous character of such ruptures is discussed in most of the previously reported papers. Brosch and his co-workers attempted to show the mechanical factors in a series of experiments on the human esophagus and apparently demonstrated that it would be almost an impossibility to rupture the normal musculature with a force of less than 10 kilograms. It must be remembered that such experiments are artificial in character and do not take into consideration the compilation of forces at work in vomiting or the effect of such strains on undefended portions of the esophagus.

Vomiting, spontaneous or induced, associated with a gastrointestinal disturbance appear to be basic in all of the cases reported. In the instance here reported diarrhea and gastric disturbance from improper feeding (artificially-fed baby) was undoubtedly contributory to prolonged vomiting. The convulsive character of the emesis is of undoubted import and may sufficiently augment the intra-esophageal pressure so as to produce a break in a susceptible portion.

There can be no doubt that in certain cases the influence of gastric digestive fluid, esophago-malacia, inflammatory processes, and vascular disturbances are all important in the initiation of the tear which probably begins in the mucosa.

A striking feature of these ruptures is the frequency with which they occur in the lower third of the esophagus and most commonly on the left side. The fact that the blood vessels are more numerous here, the proximity to, and the possibility of peptic digestion, the fixation by the crurae of the diaphragm, and the involuntary character of the musculature have been offered as explanatory.

It would seem to us that the anatomic relationship of the eso-

phagus at this point should be considered pertinent. In the chest, the aorta and the esophagus entwine each other and are thereby mutually fortified. The extra support comes from surrounding tissue. However, immediately back of the pericardium the esophagus lies in contact with the right pleura but is deprived of the fixing influence of the left, and is therefore partially unsustained externally. This, with the angulation occurring as the result of crowding by the aorta, may possibly lead to additional vulnerability.

Of interest in connection with the point of rupture is a case in which the rent occurred in this usual area, as the result of indirect trauma in a middle-aged man who was necropsied by one of us (Menne) after exitus from a basal skull fracture. In this case the surgeons (Rockeys), requested an examination because of the sudden death from shock that could not be explained by the existing injury.

Clinically all of these cases result in profound shock and terminated fatally in an average of about 17 hours.

In conclusion, it might be said that the spontaneous character of rupture of the esophagus appears to be disputed. However, such tears appear at a vulnerable point with a minimum of pre-existing disturbance. Further, the infrequency in children of this condition probably is concerned with the lack of violence that accompanies retching and vomiting in adults, in whom the condition is also a very rare finding.

In the case, the subject of this report, there is present the occurrence of this very rare and serious lesion in a young baby and although it may have a minor significance it serves to forcibly illustrate another of the many deplorable consequences that may result as a failure to maintain breast feeding.

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# ARCHIVES OF PEDIATRICS

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## ORIGINAL COMMUNICATIONS

### PNEUMOCOCCUS PERITONITIS IN INFANCY AND CHILDHOOD.\*

By HENRY HEIMAN, M.D.

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*Introduction.* During the past 8 months, 5 cases of pneumococcus peritonitis were admitted to the Children's Wards of Mount Sinai Hospital. Although a large number of studies have been made on this comparatively rare condition, the difficulties we encountered in diagnosis and in the selection of correct therapeutic procedures among our first cases were many. This prompted us to a closer survey of our past records and a more intensive study

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From the Pediatric Service of The Mount Sinai Hospital.

of the recent cases. We shall present an analysis of 15 cases observed in the medical and surgical wards of the pediatric service during the past 5 years.

*History.* Long before the discovery of the pneumococcus, cases of idiopathic peritonitis in infancy and childhood were observed. In 1842, Duparcque<sup>1</sup> described 5 cases of essential peritonitis in young girls between the ages of 5 and 12 years. In 1861, Rilliet and Barthez<sup>2</sup> observed 2 cases of suppurative peritonitis with localization of pus, and rupture through the abdominal wall. Baizeau<sup>3</sup>, in 1874, described 2 cases of suppurative peritonitis with abscesses that ruptured spontaneously through the umbilicus. Both recovered. Two years later, Gauderon<sup>4</sup> collected 24 cases and added another of idiopathic peritonitis occurring in infancy and childhood. From their history and clinical course some of these cases were undoubtedly due to a pneumococcus infection.

The first case in which the encapsulated diplococci were recovered from the peritoneal exudate was that described by da Bozzola<sup>5</sup>, in 1885. The following year, Cornil<sup>6</sup> performed the first necropsy on a case of pneumococcic peritonitis complicating pneumonia and empyema. In 1890, Sevestré<sup>7</sup> reported the first successful operation on a child with a primary pneumococcus peritonitis. There followed a considerable number of studies by French workers, notably Blackburn<sup>8</sup>, Michaut<sup>9</sup> and Batisse<sup>10</sup>. In 1903, important contributions were made by von Brunn<sup>11</sup>, who collected 57 cases of the disease in childhood, and by Jensen<sup>12</sup>. In England a comprehensive study was made by Annand and Bowen<sup>13</sup> who were able to find reports of 91 cases in children under 15 years of age. In this country the literature on the subject includes contributions by Mathews<sup>14</sup>, Kahn<sup>15</sup>, Abt<sup>16</sup> and Beavan<sup>17</sup>.

*Incidence.* Pneumococcus peritonitis is a rare disease. Among 47 cases of general peritonitis in infancy and childhood examined bacteriologically, Netter<sup>18</sup> found the pneumococcus once.

Of 171 cases of general peritonitis admitted to the Babies' Hospital of New York during the past 13 years, 9 were caused by a pneumococcus infection.

During the past 5 years, 125 cases of general peritonitis were treated in the Children's Wards of Mount Sinai Hospital. The pneumococcus was isolated in 15.

The disease is more prevalent among children under 15 years, than among adults. Mathews<sup>14</sup> gives the ratio as 3 to 1. We have found records of but 2 cases treated in the adult wards during this period. The ages of our patients ranged between 9 months and 14 years,—7 cases below 5 years, 7 between 5 and 10 years, and 1 of 14 years.

A very striking fact, which is noted by the majority of workers, is the comparatively high incidence of the disease in females. Of 91 cases collected by Annand and Bowen<sup>13</sup>, 73 per cent. occurred in females, 27 per cent. in males. In our series there were 13 females and 2 males. Armstrong<sup>19</sup> believed that the fallopian tubes were the seat of primary infection in a large proportion of the cases but there has been insufficient proof.

*Mode of Invasion.* The mode of invasion of the organism has been the subject of much controversy. In the secondary cases, or those in which the peritonitis is preceded by a pneumococcus infection of another part, the organism is undoubtedly carried by the blood stream. In the primary cases, Jensen<sup>12</sup> believed the infection was carried through the gastrointestinal tract. He fed some animals with virulent cultures of pneumococci in capsules, and at autopsy found a purulent peritonitis and a follicular enteritis with but slight necrosis of Peyer's patches. There were no ulcers or perforations. The organisms were isolated from the intestinal wall, canal, blood and peritoneum. Flexner<sup>20</sup> reported the first case of pneumococcus peritonitis secondary to intestinal ulceration. Direct extension through the tissues of the diaphragm of an inflammatory process has been suggested but this has not been substantiated by sufficient evidence. Four of our cases complicated an acute bronchopneumonia; 11 belonged to the primary group.

*Pathology.* The appearance of the peritoneal activity is pathognomonic. There is at first a diffuse inflammatory process characterized by the deposit of a large quantity of fibrin on the viscera, often matting together loops of intestines. The free pus is of greenish yellow color, odorless and containing flakes of fibrin. In some of the cases the process tends to localize, adhesions develop and an abscess is formed, usually in the umbilical region.

Abscess formation occurred in but 4 of our 15 cases.

In 9 cases we determined the type pneumococcus as isolated from the peritoneal cavity:—Type I, 5 cases; Type II, 1 case; Type III, none; Type IV, 3 cases.

Blood cultures: Blood cultures were taken in 8 cases, 5 proved positive for pneumococcus, 3 for Type I, one for Type II, one for Type IV. Two blood cultures were sterile, one contaminated.

A number of workers have laid stress upon the unusually high leucocytosis in this condition. We have not found it characteristic of our cases. Of 10 cases with blood counts recorded, 4 showed a leucocyte count of less than 10,000, three between 10,000-20,000, one of 22,000, and 2 above 30,000. The highest count reported was 36,000 with 93 per cent. polynuclears.

*The Course of the Disease.* The course of the disease may be divided into 3 phases. The first is a sudden stormy onset with severe abdominal pain, vomiting, rise in temperature, rapid pulse and prostration. The anxious expression and drawn features appear early. The pain is usually generalized, but in 5 of our cases it was quite definitely, most marked in the right lower quadrant. Vomiting was a pronounced symptom in 10 of our cases.

Considerable has been written about the diagnostic significance of diarrhea in pneumococcus peritonitis. It was present in but 4 of our cases. Constipation was marked in 6 cases. The average range of temperature was 103° to 104°.

Physical signs frequently fail to explain the extreme toxic condition of the patient. The degree of abdominal rigidity is not as marked as in other forms of peritonitis. Signs of fluid are not often elicited. Perhaps this is due to the character of the exudate. Tenderness, usually generalized, may be localized to one quadrant.

In the second phase, the general condition improves, vomiting becomes less marked or absent, the temperature drops to normal and the abdominal signs become less evident.

The third phase is characterized by the presence of a circumscribed mass in the abdomen, usually in the umbilical or hypogastric region. The temperature rises, becomes intermittent and the patient gradually loses strength from the toxemia. By rectal examination tenderness is frequently elicited and there may be felt a thickening or sagging of the peritoneum. A definite mass may often be palpated. Death ensues from the toxemia, or re-

covery may follow the spontaneous rupture through the abdominal wall, or operation.

The development of more than one abscess has been described. In a case reported by Galliard<sup>21</sup>, one abscess localized between the liver and diaphragm and another around the spleen. In a case described by Sevestré<sup>17</sup>, one abscess formed in the true pelvis and another in the cecal region.

We do not believe with Michaut<sup>9</sup> that the diffuse and localized forms of the disease represent 2 entities caused by different strains of the organism. These are stages of the same process, abscess formation depending in large part upon the resistance of the individual. A. V. S. Lambert<sup>22</sup> reported an interesting group of cases from the Presbyterian Hospital in New York. The father developed a pneumonia caused by (Type 1) pneumococcus. Two days later a daughter became ill with a diffuse pneumococcus peritonitis (Type I) organism, and the nurse developed a pneumococcus peritonitis which localized (Type I) organism.

*Diagnosis.* The diagnosis of pneumococcus peritonitis may be suspected when, in a female child, there develops suddenly severe abdominal pain, vomiting, high fever, and rapid prostration with abdominal signs that are not convincingly those associated with the usual forms of peritonitis. We may find but slight rigidity or a resistance sometimes described as the "doughy abdomen" with no definite signs of fluid. With the development of a mass in the umbilical region the diagnosis becomes simplified.

From an acute appendicitis the differential diagnosis is most difficult. This was the pre-operative opinion in 3 of our earlier cases in this group. The pain and tenderness of pneumococcus peritonitis may be most marked in the right lower quadrant. Vomiting and fever are symptoms common to both. The overwhelming toxemia, however, giving rise to early prostration, the anxious expression, the gray color and sunken eyes is diagnostic of the pneumococcus infection.

In one case the diagnosis of chronic ileocecal intussusception was made. This was in a male infant of 9 months that screamed wildly on touching the abdomen. Vomiting was marked. The temperature range was between 100° and 102° and the leucocyte count was 6,000. A mass about 2 inches long was felt in the suprapubic region. There was no definite rigidity. The child died

and post-mortem examination showed the characteristic peritoneal exudate with abscess formation. *Pneumococcus* was isolated from the pus.

During the past 6 months we have employed a method in diagnosis, which has given us invariably good results. Dr. Howard Lilienthal<sup>23</sup>, Attending Surgeon to the Hospital, suggested abdominal aspiration in all suspicious cases. We used this procedure in 4 of our recent cases and were able to make a positive diagnosis of *pneumococcus peritonitis* in all of them before operation. An ordinary hypodermic syringe is used and only the finest calibered needle. The point of preference for puncture is one inch below and one inch to the left of the umbilicus in order to avoid the possible prolongation of the omental process of the round ligament of the liver and to penetrate an area over the small intestines only. The skin in this region is swabbed with iodine, a tiny incision is made to avoid contamination and the needle is inserted very slowly. The intestines tend to recede. We were able to obtain sufficient pus for smear examinations and cultures in all cases.

Denzer<sup>24</sup> has suggested the use of glass needles beveled at the point. By capillary attraction sufficient exudate may be obtained for diagnosis. Siphonage may be employed to obtain larger amounts. The disadvantage, as the author points out, is the possibility of breaking the glass during manipulation.

*Prognosis.* The prognosis depends in large part upon the localization of the inflammatory process and the involvement of other organs. Mortality figures have varied considerably. Of the 91 cases collected by Annand and Bowen<sup>13</sup>, 45 showed abscess formation. Fifty-four were operated upon, 37 recovered and 6 died, a mortality of 13 per cent. Of 46 cases in the diffuse stage, 18 underwent operation with 12 deaths or 66 per cent. mortality. All those not operated upon died, making a total mortality of 89 per cent. in the acute diffuse stage. All 4 cases described by Abt<sup>16</sup> died. Mathews<sup>14</sup> described 5 cases in the diffuse form with 100 per cent. mortality. Of 7 cases of secondary *pneumococcus peritonitis* reported by Beavan, 2 cases that presented abscess formation recovered. The other secondary cases and 5 of the primary form died. In our series of 15 cases, 13 died and 2 recovered, a mortality of 86 per cent. Of 11 cases in the diffuse



form and 4 cases with abscess formation, one recovered in each group. The case with abscess formation was admitted to the hospital with a purulent discharge from the umbilicus. Three and one half months previously, it had been treated in another institution for typhoid fever, and had subsequently undergone an operation for mastoid disease. *Pneumococcus* (Type IV) was isolated from the discharge. The abscess was drained and the patient made a complete recovery.

The second case that recovered, complicated an acute bronchopneumonia. It was a diffuse process caused by the pneumococcus (Type I). Two drainage tubes were inserted in the upper abdomen and pelvis.

*Treatment.* Whipple<sup>25</sup> has reported good results following the injections of antipneumococcic serum. Of the 3 cases caused by pneumococcus (Type I), 2 recovered. We have employed it intensively in 4 cases (Type I), but without avail.

In those cases that present localized collections of pus all writers agree that surgical intervention should be employed. There has been considerable difference of opinion, however, with regard to the correct procedure in the acute diffuse stage of the disease. Annand and Bowen<sup>13</sup> and Woolsey<sup>26</sup> recommended operation as soon as the diagnosis is made. Kahn<sup>15</sup> and Beavan<sup>17</sup> oppose operation in the diffuse inflammatory stage.

From our study of this condition we believe the best treatment is to give an abundance of fluid by hypodermoclysis and proctoclysis and to keep the patient under the influence of opium during the acute onset of the diffuse process. If the toxemia as manifested in the temperature, pulse, and appearance tends to lessen, it is advisable to wait for abscess formation before opening the abdomen. If, however, under supportive treatment, no signs of improvement appear, it is best to resort to surgery.

We wish to express our indebtedness to the attending surgeons of Mount Sinai Hospital for permission to use some of their material.

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TO FASTEN THE INTUBATION TUBE (Pediatria, Naples, May 15, 1921). D'Anna relates that further experience has confirmed the harmlessness and the reliability of Polverini's method of fastening the tube in the throat so that the child is free to be out of doors, etc., without danger of its coughing up the tube. He describes the five most recent cases in which this was done. An ordinary suture needle, threaded with 2 m. of strong silk, is introduced on the median line at the junction of the middle and lower thirds of the thyroid membrane, and is brought up and out through the mouth. The upper ends of the thread, after cutting off the needle, are tied around the O'Dwyer tube which is then introduced as usual. The lower ends of the silk thread, projecting from the neck, are tied over a roll of gauze, and thus fasten the tube permanently in place. The lower ends of the thread are coiled on the neck and protected with a dressing; the upper ends are tied around the ear. The disadvantages of such a thread are amply compensated by the freedom it gives the child, and the relief, in private practice, from dread of the tube's being coughed up. Sixteen years' experience with this method have placed it on a solid footing. The tube can be taken out to be cleansed at need. He says that if there is already a tube in the throat, this is not removed when the needle is introduced. The tip is guided by the finger in the throat until it can be seized with forceps.—*Journal A. M. A.*

## VON JAKSCH'S ANEMIA.\*

SYNONYMS: Anemia pseudoleukemia infantum V. Jaksch; Anemia splenica infantum; Pseudo-pernicious anemia of infants; La maladie de V. Jaksch-Luzet.

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The greater the number of cases of V. Jaksch's anemia one studies the more one is impressed by the great diversity of the hematological pictures. Blood features, which in the adult are considered characteristic of leukemia or of pernicious anemia, are here encountered side by side in the same case and in varying complexes in different cases. Henoeh despairs of being able to reduce the blood findings to a workable classification, declaring that it is more profitable to dwell on the clinical aspect of the disease.

Clinically, the symptom-complex of anemia with splenomegaly had been known among English and Italian observers as anemia splenica infantum. V. Jaksch, in 1889, noting certain similarities of the disease to leukemia as well as important departures, proposed for the condition the name of anemia pseudoleukemica infantum. Notwithstanding the objection that this term had been previously employed to designate a disease without distinctive blood changes, such as Hodgkin's disease, this appellation has been retained in medical literature alongside with the synonym, V. Jaksch's anemia.

As laid down by V. Jaksch, the distinguishing marks of this disease were: splenomegaly, moderate leucocytosis and decrease of eosinophiles. Luzet, in 1891, pointed out the presence of numerous nucleated red blood cells and poikilocytes. Weill and Clerc added to the picture the finding of myelocytes. The conception of the disease was thus amplified by French observers and hence the hyphenated name in vogue in France, la maladie de V. Jaksch-Luzet.

As implied in the name, this type of anemia occurs in infancy, appearing toward the close of the first and the beginning of the second year or, to be more precise, between 6 and 18 months. This is the age, as Heubner significantly remarks, when other

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\*Read before the Mt. Sinai Pediatric Staff, June 13, 1921.

diseases peculiar to infancy, notably, rickets, scurvy, tetany make their appearance. Generally there is a history of pallor and of lowered vitality from birth, perhaps of prematurity or of twin birth. Often there is a history of an early resort to artificial feeding, digestive disturbances and of unhygienic surroundings. In some cases there is a record of an acute infectious disease preceding the onset of the malady. Occasionally, however, the disease seems to have started in a child previously normal.

Regarding the rôle which certain specific diseases seem to play in the causation of this syndrome, it should be noted, in the first place, that rickets is very frequently associated, so frequently indeed, as to have prompted some writers to call this disease "rachitic anemia." On the other hand, Hallez, tabulating 124 cases, selected for unimpeachable accuracy and completeness of observation, finds the number of heredosyphilis in the lead; thus:

Heredosyphilis . . . . .	47	Nutritional Disorder . . . .	15
Rachitis . . . . .	27	Malaria . . . . .	7
Tuberculosis . . . . .	11	Unknown . . . . .	17

In the Mediterranean countries kala-azar is responsible for a number of cases of splenic anemia of infants. It is questionable, however, whether the splenic anemias resulting from malaria or kala-azar should be grouped with the disease we are now studying. In these diseases there is leucopenia and the morphological findings are different.

The disease develops insidiously with pallor, anorexia, feebleness. The pallor has a waxy yellow-tinge, reminiscent of pernicious anemia. The abdomen is protuberant. On examination one usually finds the rachitic skeleton. The spleen is enlarged and extends to the navel or below it. It is smooth, movable and tender. The liver is but moderately enlarged. The lymph nodes are but slightly enlarged or just palpable. Over the heart, hemic murmurs are heard. In a case recently observed at the Mt. Sinai Hospital, on the service of Dr. H. Heiman, the murmur closely simulated mitral insufficiency and cleared up with the little patient's improvement. There is usually moderate fever, which may be due to the disease itself or to a complicating infection. The respiratory tract is prone to catarrhal inflammations, bronchitis and bronchopneumonia being most frequently responsible for the fatal outcome.

Now and then ecchymoses are found both into the skin and the mucous membrane. Urobilinuria has been observed by some.

*Hematology.* As a rule there is severe anemia. In the average case the reds number 2 to 3 millions, but may exceptionally fall to 500,000 or remain close to normal. The hemoglobin averages 30-40 per cent. It may be even lower. The color index is usually minus 1, but may be plus 1. There is a marked aniso- and poikilo-cytosis, also polychromatophilia and basophilic degeneration. Nucleated red cells are numerous. In one case in the records of the Mt. Sinai Hospital they reached 260,000 and many show bilobular and trilobular nuclei and mitotic figures. Megaloblasts and megalocytes are common. The blood platelets are reduced in number. Occasionally they may be increased.

The white blood cells in the text-book case range between 20,000 and 50,000, but their number may vary from normal to 200,000. The polynuclear neutrophiles average 20 to 30 per cent. The large mononuclears run as high as 20 per cent. and higher. The eosinophiles are reduced and may disappear altogether. The myelocytes ordinarily form  $\frac{1}{2}$  to 6 per cent., but may go up much higher. In a case of Griffith's they reached 45 per cent. As to the lymphocytes, V. Jaksch believed that lymphocytosis was a cardinal feature of the disease. Geissler and Japha shared this view. Heubner, on the other hand, found in his cases a preponderance of polynuclears and considered the blood picture as a whole as a result of compensatory hyperfunction of the myeloid centers in response to a severe blood destruction. Hunter, of Glasgow, considers the preponderance of lymphocytes as well as the numerical relationship between these and the polynuclear neutrophiles as normal for the age. It is possible, however, that, as was recently pointed out by Hirschfeld, in the lymphocyte count of the earlier writers were included myeloblasts, as until recently this distinction was not clearly recognized in hematological work.

*Pathology.* As in other respects, there is no unanimity among clinicians in this particular. I shall here follow in the main the conception of Hirschfeld, who, judging by his voluminous bibliography, has exhausted the international literature on the subject and given, as it were, a composite image of most of the recorded cases extant:

The organs look exsanguinated. The skeleton shows rachitic

lesions. The spleen is much enlarged and is the seat of 2 pathological processes: (1) Hyperplasia of the hemopoietic elements which suggest a reversion to the fetal state. (2) A sclerosing process. There is perisplenitis and on section there are seen coarse trabeculae radiating from the adventitial coats of the Malpighian arteries and dividing the pulp in compartments. Here and there are also encountered corpses of normocytes and macrophages carrying such defunct red blood cells as well as ferruginous pigment. The Malpighian corpuscles are atrophied.

The liver is but slightly increased. Here, too, there are evidences of myeloid metaplasia. Those familiar with the embryonal structure of the liver, the myeloid activity encountered here strongly reminds of that state (Hallez).

Sasoukhine, cited by Ostrowski, found a sclerosing process in the splenomegalies of rickets and gastroenteritis. Erythroblasts and myeloid activity of any sort was, however, here absent.

The bone marrow shows increase of connective tissue. There appears a hypergenesis of nucleated cells, megaloblasts, normoblasts with nuclei. Myeloblasts are increased and may be grouped in nodules.

The lymph glands may show only follicular hyperactivity with the sinuses gorged with lymphocytes, mononuclears, macrophages, etc. Or there may be here, too, myeloid metaplasia. The thymus: (1) may be normal, (2) may show lymphoid hyperplasia or (3) may be the seat of myeloid metaplasia.

Hallez, who from histo-pathological appearance is inclined to view the myeloid metaplasia as a process of reversion to the fetal state of hemopoietic activity, argues that, in contradistinction to leukemia, there should not here be found myeloid infiltrations in organs such as the kidney, which in fetal life did not enter in the hemopoietic system. As, however, myeloid transformation is found also in non-hemopoietic organs, the same as in true leukemias, Hallez concludes that there is no absolute criterion by which to distinguish pathologically between genuine leukemia and pseudo-leukemia infantum.

*The Course* is generally subacute. The disease may, however, prove fatal in a few weeks, or, with remissions, may run a few years. The fatal termination is in the majority of cases due to an intercurrent infectious disease, notably bronchopneumonia. Some

die as the blood assumes a more typical leukemic picture and are then said to have died of leukemia.

*Prognosis.* The mortality is variously given as 25-50 per cent. V. Jaksch considered the favorable outcome as an important differential point in distinguishing this disease from true leukemia. It is said that a high color index is unfavorable. A high white blood cell count is not necessarily a bad omen as Baginski's case with 122,000 recovered. Neither is a high myelocyte percentage of serious import, as Griffith's case took a turn for the better shortly after their number rose to 45 per cent. According to Cohen, a drop in the eosinophiles is of bad significance, while a rise is favorable.

In the individual case the prognosis may be affected by the hazards of an intercurrent disease.

*Treatment* must in the first place be directed to the fundamental disease, such as rickets, lues, tuberculosis, malnutrition, etc. Seeing that the disease is but rarely met with in the breast fed, breast feeding should prove beneficial. Cod liver oil is frequently indicated for the associated rickets. According to Hallez, antiluetic treatment should be indicated in a great proportion of the cases. Iron in large doses is recommended by Heubner, who is, however, skeptical of the efficacy of arsenic. V. Jaksch treated his cases with arsenic with good results. One of Marfan's cases showed no improvement from arsenic. The parents became impatient and took the child to the country. Nine months later they brought the child cured. Koplik stresses the importance of regulating the diet and the bowel movements. Hunter, of Glasgow, advises attention to the child's diet and hygienic surroundings without recommending any particular drug. Combes of Paris saw good results from opotherapy—he gave calf's bone marrow in teaspoonful doses. As for splenectomy, it does not seem rational, as the splenic affection is conceded to be secondary. It has, however, its advocates. Wolf, Giffin, and recently Mayo, reported cures by this operation. X-ray and radium may be tried. Here it is well apropos to cite a recent observation at the Mt. Sinai Hospital, on the service of Dr. H. Heiman, to whom I am indebted for this valuable opportunity. One of twin sisters which were admitted for pseudo-leukemia infantum did very well on cod liver oil and iron. The

other, to whom this treatment was denied, went from bad to worse and was saved from imminent death by transfusion. Following the transfusion, iron was given, but no cod liver oil. The high fever dropped almost simultaneously with the transfusion and the child made an uneventful recovery.

*Nature of the Disease.* In the present state of our knowledge it is difficult to say whether V. Jaksch's anemia is a primary blood disease peculiar to infancy, in which rickets, lues, tuberculosis, etc., are but the predisposing factors, or whether it is a symptomatic anemia which owes its polymorphism to the immature state of the infantile blood forming organs and their ready reversion to the fetal type; whether it is an infantile variant of pernicious anemia or of myeloid leukemia or perhaps all forms of adult anemia are here represented with their individuality obscured by the irregular reaction of the infantile bone marrow to blood irritants. All these conceptions have had their propounders.

V. Jaksch differentiated this disease from myeloid leukemia on the following grounds:

1. The absence of eosinophiles and mast cells.
2. The preponderance of lymphocytes.
3. The absence of leukemic infiltrations.
4. The favorable outcome.

As we have seen, none of these points are rigidly applicable. Lehn-dorf, for instance, who considers the disease an infantile form of myeloid leukemia, regards V. Jaksch's differential points as non-essential. Adult anemias, too, may appear in atypical forms as, for example, leukanemia. Again there are on record instances of adult leukemias with recovery. Those again who regard this disease as an infantile variant of pernicious anemia point to the experiments of Rekzeh, who, working with pyrogallol, could produce in adult dogs the blood picture of pernicious anemia, whereas in the young the blood findings resembled those met with in V. Jaksch's anemia. Among the French observers, Luzet, Weil and Clerc considered the disease a myelemia or a forme fruste of myeloid leukemia. Weil and Clerc were much impressed by the high percentage of myelocytes in their cases, up to 10 per cent., as well as by their post-mortem findings. They found myeloid transformation of parts of the splenic pulp, myeloid hyperactivity of



the bone marrow and of the lymphatic glands. On the other hand, Maher, Nan and Rose attempted to divide the disease into 2 groups, namely:

1. True pseudoleukemic anemia characterized by anemia and lymphocytosis, myelocytes 0-1 per cent.
2. Myelogenous leukemia, forme fruste, characterized by nucleated reds, myelocytes 10 per cent.

Hallez, in a very minutely detailed autopsy protocol of one case, showed that the liver and the spleen presented "an unmistakable return to the fetal type" as distinct from a leukemic appearance.

Hunter, of Glasgow, reported 10 cases, 4 with autopsies. Only one of these showed leukemic infiltration of the spleen, liver and kidneys. Hunter considers the possibility of this last one case having been a true leukemia, although he admits that clinically there was no essential difference to distinguish this case from the other three. After a very interesting discussion he comes to the conclusion that the V. Jaksch syndrome is but a functional blood disorder due to a debility of the infantile hemopoietic system, either congenital or acquired. Even anemia is not essential—just a derangement of blood formation. Two of his series, twin sisters, had almost no anemia, but showed all other disorders found in this disease.\*

G. Ward, of London, calls attention to the fact that numerous cases of symptomatic leukemia are recorded in literature which occurred in the course of various infections which are benign. He considers V. Jaksch's syndrome as of a toxi-infectious origin and suggests the name "secondary infective myelemia of infancy."

Koplik reported 2 cases clinically typical of V. Jaksch's anemia, and, moreover, showing myelocytes in the blood in which, post-mortem, the spleen, liver and bone marrow were found negative. Koplik further cites the investigations of Zelenski and Cybulski showing that myelocytes may be found in infantile blood in cases other than anemia, thus making their presence irrelevant for purposes of diagnosis. Koplik comes to the conclusion that cases such as were described by Lehndorf, Luzet, Weil and Clerc did not belong to the V. Jaksch group at all, but were true leukemias.

\*A similar case was observed by Ostrowski.

Out of 6 autopsies, Cohen of Brussels found numerous nucleated red blood cells and an increased number of white blood cells in the spleen of one. One showed nodular syphilomas. In the remainder the findings varied from negligible to negative.

The findings of Koplik like those of Hunter lead to conclusions diametrically opposite to those reached by Lehdorf, Luzet, Weil and Clerc. A comparison, however, of the clinical course and of the blood counts of those cases that did and of those that did not show leukemic infiltrations in the parenchymatous organs, fails to disclose any criteria by which the absence or presence of these lesions could be inferred during life.

Another circumstance which adds to the complexity of the problem is the fact that cases have been observed in which the blood picture changed radically in the course of the disease. Griffith, for example, reports a case which at first conformed to the type of pernicious anemia, but later became typical of myeloid leukemia. There are cases on record which at first were classified as V. Jaksch's anemia and later changed to the form of myeloid leukemia. To some, such an occurrence argues in favor of considering V. Jaksch's anemia as a preleukemic state; others, like Koplik, who are bent upon regarding the 2 diseases as distinct, contend that cases such as these were leukemias from the start. The safest attitude, it would seem, is to avoid dogmatism and reserve judgment until more definite knowledge is available.

For the better comprehension of V. Jaksch's anemia, a brief review of the development of hemopoësis is essential.

The seat of blood formation toward the second month of embryonal life is in the spleen and in the liver. At first there are only nucleated red blood cells in the circulation, then non-nucleated forms appear and these gradually become predominant.

In the third month, the blood forming function is taken over by the marrow. Thereafter *no* nucleated reds are normally found in either the spleen or the liver. At birth, the number of nucleated reds in the blood is small and they disappear from the peripheral circulation after the fourth day. Myelocytes are normally found in the blood in the first few weeks after birth.

Early in embryonal life the hemopoietic tissue is homogeneous, the lymphatic elements being indistinguishable from the myeloid.

Gradually there appears a tendency toward specialization and when this is complete the myeloid elements are confined to the bone marrow and the liver, while the lymph glands, the thymus, Peyer's patches, etc., become the seat of lymphoid cells. This unity of origin of both types of blood cells helps reconcile the apparent contradiction of the simultaneous increase of the products of both lymphoid and of myeloid hyperactivity which is unusual in adult blood.

#### SUMMARY.

1. In the present state of our knowledge a case of anemia with splenomegaly occurring in infancy which does not clearly fall in the category of a recognized disease entity of the adult, while showing abnormal cell forms, such as normoblasts, megaloblasts, myelocytes in the circulating blood, may be conveniently grouped as V. Jaksch's anemia, or anemia pseudoleukemica infantum.

2. The conventional case will present a severe anemia, considerable splenomegaly, moderate liver enlargement, slight adenopathy, a rachitic skeleton and a pale, waxy complexion. The blood examination will show oligochromenia, oligocythemia, numerous normoblasts, a varying number of megaloblasts and of myelocytes. The W. B. C.'s will range between 20,000 and 50,000. The polynuclear neutrophils will form about 35 per cent., the large mononuclears about 20 per cent., the myelocytes about 4 per cent. The eosinophiles are reduced to 0.0-0.5 per cent. The age of the patient is 6-18 months.

3. The blood picture may vary from time to time and may even change in type. Repeated blood counts should be made.

4. Special study should be made of the mononuclear cells to distinguish myeloblasts from lymphocytes. The older blood counts are sadly deficient in this respect.

5. The postmortem findings of cases which clinically warrant the diagnosis of V. Jaksch's anemia may disclose leukemic changes, or myeloid metaplasia, in the spleen, liver and bone marrow or may be negative in this regard. Whether these differences signify that we are here dealing with 2 distinct diseases or with 2 stages of the same disease; whether the term V. Jaksch's anemia is to be restricted to cases with negative findings while the other variety is to be classed with true leukemia—these are questions

which for the present must remain open. Be this as it may, there is no differential point by which to distinguish the 2 during life. For practical purposes, therefore, we must name alike, provisionally, at least, all such cases as described above, V. Jaksch's anemia.

Before concluding, I shall review a few interesting cases from the records of the Mt. Sinai Hospital, illustrative of the problems of diagnosis. For the privilege of consulting these case histories I am indebted to Dr. Henry Heiman.

1. 1916. S. S., 9 months, pale from birth, mixed feeding. Spleen and liver 2 fingers below costal margin. Hbg. 32 per cent. R. B. C. 2,800,000, small lymphocytes 52 per cent., large, 1.6, eosinophiles, 2, W. B. C. 18,200.

*No abnormal cells.* The splenic enlargement here was moderate, and there were no products of abnormal blood regeneration in the circulating blood. The eosinophiles were about normal. Clearly, this case did not properly belong to the V. Jaksch group.

2. D. K., 6 months, well until 9 days before admission. Death within 2 weeks. Large spleen, waxy skin, Hbg. 30, R. B. C. 1,300,000, Color Index 1.15, W. B. C. 84,000, polys. 58 per cent., large lymphocytes 4, small lymphocytes 38. Died with melena. Here is an example of splenomegaly, anemia, leucocytosis—3 important characteristics of pseudoleukemia infantum as laid down by V. Jaksch. It departs from the classical picture by the acuteness of its course, the fatal outcome and the polynucleosis. The high color index, the presence of megaloblasts place the disease close to pernicious anemia. In pernicious anemia, however, there is no splenomegaly, there is leucopenia, the course is not acute and the tendency to hemorrhages is not outspoken. Probably it was for cases such as this that the name of pseudopernicious anemia was coined, I believe by Ehrlich. Again, the combination of characteristics of leukemia with those of pernicious anemia, the acute and fatal outcome, the tendency to hemorrhage remind one of leukanemia in the adult. And leukanemias, as well as the acute leukemias in general, are considered by Sternberg as manifestations of sepsis.

3. 1918. S. W., 11 months, acute onset, death in 4 weeks. Marked splenomegaly, slight adenopathy, W. B. C. 640,000, reported to be myelogones and myeloblasts. This case is hemato-

logically very much unlike V. Jaksch's anemia. The right appellation for it is acute myeloblastic leukemia.

4. V. A., 7 months, pallor, rickets, Hbg. 27, R. B. C. 1,472,000, Color Index 0.9, platelets 160,000, W. B. C. 104,000, polys. 30, lymphos 26, monos (probably myeloblasts) 40 per cent., myelocytes 4 per cent., aniso- and poikilocytosis, many monoblasts. Here is a case of a typical V. Jaksch blood count with no splenomegaly. How is it to be grouped? If we conceive of a pseudo-leukemia infantum primarily as a hemopoietic disorder, splenomegaly does not seem to be essential. The age, the associated rickets, the myelemia with erythroblastosis, the favorable outcome, all stamp it as such. We have seen above that there may be splenic anemia infantum *without anemia* and here we are confronted with apparently another paradox of anemia splenica infantum *without splenomegaly*. Riviere may be right in declaring, somewhat sententiously, that in speaking of anemia splenica infantum the emphasis is to be placed on the infantum part of the syndrome.

5. 1919. H. S., 15 months, blood typical of V. Jaksch's anemia. The rachitic lesions were very pronounced. In an instance such as this the question will always crop up, is it not more reasonable to consider the anemia as merely symptomatic of the rickets and call it secondary symptomatic anemia? It may well be so, but until we possess more exact hematological knowledge it is expedient to employ such a non-committal name as V. Jaksch's anemia.

6. 1921. H. D. and P. D., twin sisters, both classical cases of V. Jaksch's anemia. These cases have been alluded to above in speaking of treatment. Here I will only comment on the fact, noted in literature before, that twins are likely to be similarly and simultaneously affected by this malady. That gemellity predisposes to malnutrition and anemia is a familiar enough fact. But that both infants should present the same type of anemia furnishes food for speculative thought: does this fact argue in favor of some specific infection or toxin to which the 2 were similarly exposed? For if V. Jaksch's anemia is merely an accidental symptom in the course of another disease, as, for instance, rickets, it is strange that in the case of twins it should affect both. Especially so, when we consider the rarity of the occurrence of this syndrome in the rachitic. Unless we assume that twins are biologically so

much alike as to react *identically* to any given toxin, be it rickets or what not? In other words, that it is not the specificity of the toxin but rather the identity of the defensive mechanism of twins which here determines duplication of the result?

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SCABIES IN INFANTS (Nourisson, Paris, July, 1921). In infants scabies assumes a pustular form, H. Lemaire remarks, and the differential diagnosis may be puzzling unless the soles are examined. The aspect of the sole of the infant will often clear up the diagnosis in dubious cases of itching dermatitis. He reports two cases which confirm that an infected scabies may prove fatal for a young infant. A transient bacteriemia entailed foci of infection in viscera, lungs and meninges. In one of the infants an accompanying eczema blanched out as a pulmonary focus became aggravated. The pulmonary focus and the general condition improved under baths, etc., which brought the eczema out again. He has on several occasions noted this coincidence, with the final recovery of the child.—*Journal A. M. A.*

## HOSPITALS FOR BABIES—RETROSPECT, INTROSPECT AND PROSPECT.\*

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On an occasion like this I may be permitted to delve into the past and briefly review through the centuries the provisions made for sick and needy children.

Before the Christian era, the social value of an infant was negligible and it was considered no crime, even in cultured Greece and Asia Minor, to expose, abandon or destroy any infant if, on account of its sex or inconvenience, its presence should be considered undesirable. Christ taught that the life and soul of a child were as precious as those of an adult and to willfully destroy an infant was murder in the first degree. He elevated and sanctified childhood and babyhood. His was the first voice raised against a high mortality and He brought the message that it was not the will of the Father that sent Him that one of these little ones should perish. A couple of centuries later, when the Roman Emperors embraced Christianity, they made infanticide and neglect of children a punishable crime.

Lactantius made the following plea for the new-born which is significant of the rapid growth of the Christian religion:—"Therefore let no one imagine that even this is allowed, to strangle newly born children, which is the greatest impiety, for God breathes into their souls for life and not for death. But men, that there may be no crime with which they may not pollute their hands, deprive souls, as yet innocent and simple, of the light which they themselves have not given. Wherefore, if any one, on account of poverty, shall be unable to bring up children, it is better to abstain from marriage than with wicked hands to mar the work of God." Under the rather striking title "An Infant Hygiene Campaign of the Second Century" (ARCHIVES OF PEDIATRICS, March, 1920), Dr. John Foote has written a most interesting account of the work and writings of Soranus, the greatest pediatrician of antiquity. He was probably born in Rome between 110 and 130 A. D. A few quotations from his book will show many similarities with the "baby books" of today. "Cry-

\*Address delivered at the opening of the Babies' Hospital, Philadelphia, May 9, 1921.

ing," he says, "is not caused by hunger alone. An inconvenient position, pressure of the clothing, irritation of the skin, too much food, excessive heat, colic and various diseases may cause crying." "Be careful not to move or swing the baby after feeding it, do not threaten it or yell at it, caress it, amuse it. Fear is bad for infants." He states explicitly what kind of a woman to choose for a wet nurse—"the essential mental qualities of a good nurse," he writes, "are patience, common sense, good nature or gentleness and neatness." This pediatrician of over 1800 years ago has not been surpassed in sound common sense and clearness of thought. It is quite possible that Soranus gained some of his knowledge from the study of babies in a hospital ward. We have no record of special babies' or children's hospitals at this period although we know that numerous hospitals had been erected in Greece, Italy and Arabia. Walsh, in his book on Medieval Medicine, describes St. Basil's Hospital at Caesarea called the Basilius which was erected in the fourth century. "This institution took on the dimensions of a city with regular streets, buildings for different classes of patients, dwellings for physicians and nurses and for the convalescent, and industrial schools for the care and instruction of foundlings and of children that had been under hospital care." Is it not fair to assume that there was a special building for babies? A few centuries later a large "hospital with a mosque and an orphanage" was erected in Damascus which was said to have had a staff of 42 physicians. As the Arabs had an advanced knowledge of medicine and surgery it is quite possible that special attention was paid to the disorders of infancy and childhood.

While no special mention is made of hospitals for children, yet the establishment of foundling asylums took place at an early period. The first of which we have authentic record was founded in the year 787 by Archbishop Datheus in Milan. In founding the asylum he said, "An enervating and sensual life leads many astray." He goes on to say that "illegitimate, new-born children would not be put to death—thrown into the sewers or the rivers, or murdered—if there were an asylum where they could be cared for." "By depriving the children of baptism they send them to Hell." "Therefore, I, Datheus, for the welfare of my soul and the soul of my associates, do hereby establish in the house that I



have bought next to the church, a hospital for foundling children. My wish is that as soon as a child is exposed at the door of the church that it will be received in the hospital and confided to the care of those who will be paid to look after them." Pope Innocent III in 1204, moved to compassion by the number of new born babies drowned in the Tiber, set aside a portion of the hospital of Santa Maria in Sassia to care for infants but it was more in the nature of an asylum than hospital. The famous hospital of the Innocents in Florence was founded in 1421. The Della Robbia Bambinos have made this institution famous.

The golden age of hospital building was in the thirteenth century. Walsh calls this "the greatest of centuries" and it followed a long world war of tremendous proportion for that day.

This period of reconstruction after the Crusades began with the signing of the Magna Charta when England discarded serfdom and granted liberty to her people. Throughout Europe, art, science, literature and education took rapid strides and ascended to pinnacles to which the world has not since attained. Virchow, in his history of hospitals, showed that every town in Europe with a population of 5,000 or over possessed a hospital. The tendency was not to have special hospitals for children but to group young and old in the same institution. Most of the hospitals had special wards for obstetrics and children and it is stated that females were always in charge of these wards. We are apt to think of medieval hospitals as unsanitary, foul smelling, ill ventilated and hotbeds of infection. To quote further from Walsh, "the hospitals built in the thirteenth century usually were of one story, had high ceilings with large windows, often were built near the water that there might be abundance of water for cleansing purposes and also that the sewage of the hospital might be carried off, had tiled floors that facilitated thorough cleansing and many other provisions that the architects of our time are introducing into hospital construction. They were a complete contrast to the barrack-like hospitals with small windows, narrow corridors, cell-like rooms, which were built even 2 generations ago and which represented the lowest period in hospital building for 7 centuries." The construction and management of hospitals sank to a low ebb from the 16th to the 19th century. The improvement began about the middle of the 19th century and was

coincident with a marked advance in the science of medicine. Here again was a reconstruction period following long years of bloody European wars. What will be the aftermath of the recent World War cannot yet be foretold. Ellen Key has termed this century "the century of the child" but 2 decades have passed and so far we have done but little to justify this claim. Let us hope that succeeding centuries will turn back to this as the century of prevention of diseases, the promotion of health and proper protection of infants.

As the knowledge of medicine advanced, more attention was paid to its various branches and the dawn of modern specialism appeared. This inevitably led to the establishment of hospitals where special classes of cases could be better cared for and studied. This growth of specialism is responsible for the existence of separate hospitals for children and babies. In the term children's hospitals, we do not include an asylum or orphanage, nor a ward or pavilion connected with a large general hospital. The first distinctly children's hospital in Europe was the Dispensary of Dr. George Armstrong in London which was founded in 1769. Lord Winchelsea was the president of this hospital and paid 50 pounds annually towards its support. Children suffering from smallpox, measles and whooping cough were excluded. Advice and medicines were given gratis and Dr. Armstrong wrote that during the 12 years and 9 months it existed the number of infant patients relieved by it amounted to nearly 35,000 children as shown by the dispensary records. The number of children receiving treatment annually during the last 5 years of its existence was 4,400. "Unfortunately," Dr. Armstrong concludes, "it met with so little encouragement that it all along lay a burden on the original institutors." This same Dr. Armstrong wrote a text-book on children's diseases which passed through several editions and described the first recorded case of congenital pyloric stenosis. "This keen observer, brilliant writer and pioneer physician-philanthropist, who was blessed with the true scientific spirit and an almost prophetic outlook, died in obscurity unpraised and unrewarded excepting in the grateful remembrance of the poor of London" comments Foote.

Dr. John B. Davis revived the Armstrong clinic in 1816 and to him belongs the credit of instituting social service through a

voluntary corps of ladies. Holt gives the following quotation from his book:—"if benevolent ladies could be prevailed upon to form district committees to visit and inspect the health of sick and indigent children, much practical good would result from a medical and moral point of view. By such visits as these it may be predicted that the instances of mortality among children will be quickly diminished at the same time that such benevolent females corrected the absurd notions and errors of the poor as to the domestic management of their children." This is probably the first instance of social service work in connection with a dispensary.

Dr. Armstrong's clinic was imitated in Vienna in 1787 by Dr. Mastalier's *Kinderkranken* Institute which was also free and by Dr. Ringolinus' *Kinderkranken* Institute in Brunn in 1810. Dr. Friedelburg founded a children's hospital in St. Petersburg in 1834 which was supported by private subscriptions. In the same year the *Charité* Hospital in Berlin opened a special pavilion for sick children. In 1837 Mauthner founded the St. Anna *Kinderspital* in Vienna which the work of Widerhoffer and Escherich has made famous.

Children's hospitals sprang up quickly in Europe and between 1837 and 1850 hospitals were erected in Budapest, Hamburg, Prague, Vienna, Munich, Moscow, Dresden, Stuttgart, Turin, Berlin, Copenhagen and in 1847 a children's hospital was founded in Constantinople.

The first children's hospital in Paris was inaugurated in 1854 by the late Empress Eugénie. The same year the first children's hospital in England was opened. The author of John Halifax, Jr., wrote as follows concerning the origin of the Great Ormond Street Hospital for sick children:—"On January 30, 1850, nine gentlemen, 2 of whom were of the medical profession, met to consider whether it was not possible to establish in London, a hospital for sick children. This was opened in 1854. Its 3 aims were: (1). The medical and surgical treatment of children; (2): The attainment and diffusion of knowledge regarding the diseases of children; (3). The training of nurses for children."

The promoter of this hospital was Dr. Charles West—the Jacobi of England—and its establishment was largely due to the efforts of his close friend, Charles Dickens, who worked hard to

make the public realize its necessity. Dickens was a real benefactor to children in other ways than through his books. In an address he delivered at the opening of this hospital, he referred to the sick children as "drooping buds" and said "the 2 grim nurses, Poverty and Sickness, who bring these children before you, preside over their births, rock their wretched cradles, nail down their little coffins and pile up the earth above their graves. Of the annual deaths in this great town, their unnatural deaths form more than one third."

The first children's hospital in America was opened in 1855 and to Philadelphia belongs this honor. This hospital was opened for children "suffering from diseases which could not be treated in their homes." There were 12 beds in which 79 patients were cared for during the first year and 306 out-door-patients.

Your city is the pioneer pediatric city of this continent and medical literature has been enriched by articles on diseases in children from the pens of Benjamin Rush, in 1789, Charles Caldwell, in 1796, Dewees, Parrish, Homer, Gerhard, Condie and Meigs, in the early years of the 19th century. The teaching and influences of these men undoubtedly laid the foundation on which in later years both the children's and babies' hospitals were established.

New York's first children's hospital was the Nursery and Child's, which was a reorganization of the Nursery for the Children of Poor Women, an asylum founded to care for the babies of wet nurses. In 1857 the name and purpose were changed and Dr. George T. Eliot, at the opening, stated "that this is the only hospital in the city where children during the fatal years of life are received, unless very exceptionally." A small child's hospital was opened in Chicago in 1865 and in Boston in 1869. After this date the number of hospitals for children increased very rapidly. These were quite small when first opened but most of them have been rebuilt and enlarged several times showing both the demand and need for such hospitals. No provision was made for babies in nearly all of these hospitals; in fact the age limit ranged from 2 to 14 years. The need for hospitals for sickly babies, constructed so that infection could be eliminated, with facilities for the preparation and preservation of the babies' food and where older children would not be disturbed soon became

evident. Babies' wards in general hospitals or even in children's hospitals are not entirely satisfactory and the results are not so favorable as in the special hospitals. Babies' hospitals should have smaller wards to lessen the chances of infection and limit its spread, good ventilation with abundant air space and proper bathing and changing facilities. There should be an incubator ward, maintained at the proper temperature and humidity for premature and immature infants, and provisions for the accommodation of wet nurses and their babies.

Richardson, in the April number of "Modern Hospital," makes the following comments on the pediatric service of a general hospital which furnishes further reasons why sick babies should be provided with special hospitals: "The usual tendency seems to be to tag a children's ward and a children's service to the tail end of the general medical, fill the ward with a general hodge podge of surgical, medical and orthopedic cases, which have nothing in common but a relative similarity of ages and let each attending treat there all of his cases who happen to be under 12 years of age. Naturally such a ward has and can have no coherent plan. The chief of the children's service can of course order nothing for the patients of other men who happen to be in the ward. Even though the general surgeon is quite willing as a rule to confess to a complete ignorance of the intricacies of infant feeding, he and the nurse must battle through the alimentation of the surgical children, until nature rallies to their aid and cures them in spite of faulty feeding, or they become so frankly cases of malnutrition that he washes his hands of them and turns them over in desperation to the pediatric service."

The Thomas Wilson Sanitarium in Baltimore was founded in 1879 for the purpose of providing hospital care in the country for infants and young children suffering from intestinal disorders. The Boston Infants' Hospital was opened in 1881 and was the first hospital in this country where only sick babies were admitted. The Babies' Hospital in New York was an offshoot of the babies' ward in the Post-Graduate Hospital and was incorporated as a separate institution in June, 1887, with Drs. Julia and Sarah McNutt in charge. They resigned in 1889, when the hospital was located on East 36th Street with a capacity of 8 beds, and Dr. L. Emmett Holt was appointed attending physician. No

one can estimate the effect these hospitals have exerted on the medical thought of this country or how far reaching have been their influence in the reduction of infant mortality and morbidity and in the scientific study and treatment of the disorders peculiar to infants and young children. If this hospital confined its activities solely to the care and treatment of the sick babies brought to its doors its functions would be negative and its efforts selfish. The watchword of Rotary, an international organization of business and professional men, is "he profits most who serves the best," and this fitly applies to the activities of a babies' hospital.

A research laboratory is a necessary adjunct to every progressive industrial plant. One of the largest buildings of the General Electric Company at Schenectady is its research laboratory. Here are employed some of the most renowned scientists of the world. They are engaged in developing ideas and improving methods, testing new apparatus and inventing simple and more economical processes. Your hospital is a research laboratory in the great business of saving babies and you are fortunate in having such a proficient medical staff to conduct this work.

Research work is conducted along various lines. The clinical bedside study is done in the wards and dispensaries and technical and laboratory work are conducted in the x-ray department and the chemical, physiological, bacteriological and pathological laboratories. Sociological data is obtained by the social service department in the dispensary and the homes.

With such equipment, investigations can be instituted to discover new truths, expose old errors, test out new methods of treatment and extend social service. We have much to learn regarding the infections of early childhood and only by a positive knowledge of the source and cause of disease can it be combated and overcome. Holt says that hospitals for infants serve their highest functions when they can determine from careful study and observation of the few what is the best treatment for the many.

Take for example one phase of nutrition—the artificial feeding of infants. Here is a vast and fertile field for research. In a babies' hospital, selected groups of cases fed on some particular method can be carefully studied and the entire process of metabolism observed and checked up. A careful analysis of the

results of the investigation could then be published and made available to the medical profession.

A hospital for babies offers many attractions to the pediatrician. The larger part of his work is devoted to problems connected with diseases and nutrition in infants. In a special hospital he has opportunity to perfect himself in his specialty. This experience is essential if he holds a teaching position in a medical school. He has competent assistants and trained nurses to take the preliminary histories and examinations, to keep careful records, charts, bedside notes and to collect specimens. The x-ray both for diagnosis and treatment is at his disposal as are the services of its various laboratories. The medical staff includes specialists along certain lines and he can readily obtain their opinion in any particular case. This team work or group medicine is a decided advantage to hospital work. With many preliminary details disposed of he is able to give more careful attention to his cases in surroundings better adapted for study than would be possible in the home of a patient.

It is often difficult to convince a mother that the hospital is the best place for her sick baby and that it is sometimes best for both mother and baby to be separated during the acute illness. Acute surgical conditions demand hospital service. Certain medical diseases which require special treatment, such as transfusions, functional kidney tests, x-rays, etc., must be taken to a hospital. A sensible mother realizes that her baby will receive skilled nursing and medical care at the hospital impossible to obtain in any private home regardless of cost. Hospital surroundings and equipment are designed to aid in the recovery of the little patients and facilities are always at hand to meet any emergency. Foote says that with the improvement in methods and administration of the hospital the patient approaches it with "confidence instead of apprehension, with alacrity instead of with reluctance, and with hope of life rather than with the fear of death."

That the specialty of pediatrics has made such rapid strides in the past 25 years is due in no small measure to the educational advantages of children's and babies' hospitals. This hospital offers opportunity for educational work which should be, and will be, fully utilized. The medical staff can give special courses

for physicians desiring post-graduate work the effects of which would be far reaching. As a result of the study of the medical causes of infant mortality in the wards and in the laboratories, measures can be inaugurated along the lines of prevention. The internes receive instruction which is of the greatest value when they enter upon private practice and their patients perhaps will benefit most on account of this experience. If they plan to become specialists, the training they receive in a good hospital is almost indispensable to their future success. The active work in prenatal clinics, child hygiene stations, etc., is carried on by the younger physicians who, having studied in a babies' hospital, are better fitted for the task. The educational influence of the hospital is greatly extended if its wards are open for the instruction of medical students by members of the staff. Holt very truly says that no single agency for the reduction of infant mortality can do as much as that which educates the medical profession through which the public is ultimately reached.

The instruction which trained nurses receive in the general hospitals is woefully lacking as regards the nursing and care of sick infants. Didactic lectures and a short and limited experience in the obstetrical wards of a general hospital are not sufficient. A few months' service in a hospital for babies after graduation from a general hospital, training school or in the senior year, will be invaluable in the career of any nurse. This is the only way in which she can obtain the practical knowledge which is essential if she desires to do good conscientious work with her little patients. Every public health or visiting nurse should be required to take a short post-graduate course of training in a babies' hospital. Unless she has had such experience she will encounter difficulty in instructing mothers not alone in feeding and caring for well babies but also when they become ill.

A training school for nursery maids was started nearly 25 years ago in the New York Babies' Hospital. This was an original and typical American idea and many similar schools have been established in connection not alone with babies' hospitals but with other infant institutions both in this country and in Europe. This opens up another educational channel, for these maids go into private homes all over the country with experience and well trained for the difficult and important duty of caring for



little babies in their homes. Such a school is of benefit to the hospital, as it provides a larger number of attendants for the babies than would be otherwise available.

The mothers and other visitors who come to see the babies receive, unconsciously perhaps, many valuable instructive object lessons in the nursing, care and feeding of infants and the importance of ventilation, cleanliness and carefulness in minor details. A further extension of educational influence would be to arrange a course of free lectures and demonstrations available for mothers and prospective mothers to be given by the physicians and superintendent of nurses.

The out-patient department or dispensary is more than an adjunct of a hospital—it is an integral part. It is of historic interest to recall that the first dispensary in the United States was started in 1786 in Philadelphia. I am informed that this dispensary still stands on Independence Square and occupies a building erected in 1801 for this purpose. You may well be proud of your dispensary record as we assemble to dedicate this new dispensary designed to care only for babies, both sick and well. Originally the term “dispensary” was used to denote a place where drugs were dispensed on a physician’s prescription. Nowadays this is but a minor function and patients are brought for examination, diagnosis, advice and treatment. In a babies’ hospital, many cases after the diagnosis is made in the wards and a proper treatment instituted can be returned home and brought at greater or less intervals to the dispensary for examination and observation. The social service worker and the visiting nurse can then check up conditions in the home. To be of the greatest value, the out-patient department should be on an equal footing with the in-patient. Similar records should be used and the sick babies examined with the same care and thoroughness as in the wards. The attending physician should be in charge and not the younger and less experienced men just serving their apprenticeship.

Dr. Fife, in his interesting report, outlines the work you are undertaking along the lines of preventive medicine. This institution can render no greater service to this community than to prevent disease and keep the babies well. Herein lies a solution of the problem of infant mortality. The prophylactic or

child hygiene clinic is a preventive clinic and should be held at a different hour and only healthy, well babies received. If they become sick, they are at once transferred to the clinic for sick babies. Systematic physical examinations, periodic weighing and intelligent supervision should be accorded each infant. The mothers are encouraged to keep their babies well and properly fed and are instructed in the elementary principles of baby hygiene. Visits to the homes are made by the social workers and nurses who advise and assist the mother in her own surroundings and with her own equipment. A visiting dietitian to demonstrate in the homes the cooking of simple and inexpensive recipes has proven of immense value in some of these clinics. The Pudding Lady of the St. Pancras School for Mothers has written an interesting account of her work and its effects on the home life and happiness of the parents.

An interesting experiment is now being conducted in connection with some of the School for Mothers in England. This is the establishment of wards for "ailing" babies, an ailing baby being not one actually ill but not thriving on account of improper feeding and home care. The idea is to place these babies under good conditions for a short period during which the mother is instructed in feeding and caring for her baby. A ward has been opened in one center for cases "where the mother needs special training in regularity of feeding and other points of infant hygiene. She can come into this ward with her baby sometimes for a very short period, sometimes for longer." I would suggest that you take under consideration a similar experiment and make this Hospital a veritable "center from which health education radiates."

Social service today is a necessary adjunct to every dispensary and hospital. It has been defined as assistance to the physicians in the education of their patients and in control of their environment. This service means not only follow-up work in the homes but a study of the home by a trained social worker. It includes the economic and domestic problems, the sanitary surroundings, mental capacity of the parents and other facts concerning the family and its environment. The collected data is of inestimable value to the doctor in dealing with the professional side of the case and in outlining a practical line of treatment. The social

workers should know when material aid should be provided and when cases should be referred to other agencies and institutions. If the father is without work she might advise and perhaps assist him in obtaining a suitable position. She can in countless ways help solve these intimate human problems in a sympathetic and tactful way. The report of your social service committee shows this department is well organized and doing excellent work and has demonstrated its value. The work should be extended, as the dispensary report shows 770 admissions, and two social workers cannot effectively or thoroughly study that number of cases in the homes.

Dr. Fife struck the keynote of successful charitable undertakings when he urged a closer coöperation with other agencies engaged in this work. Elimination of duplication, and overlapping and wasting of efforts can be made possible only through co-operation and coördination. With it you will become a powerful local influence in saving the babies and promoting the health of the future citizen and his mother. Along these lines are abundant opportunities for the service in this community. Your talents must not be buried in a napkin nor your light hid under a bushel. St. Vincent de Paul believed that the doing of good should not be shut up behind cloistered walls, so he organized the Sisters of Charity to work in the streets and in the homes of the poor. A parallel is found in the new concept of the hospital. Actual treatment is carried on in the hospital but the further extension of the hospital as a teaching center extends into the streets and the homes and not "behind cloistered walls."

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INTERMITTENT ALBUMINURIA IN CHILDREN (British Medical Journal, May 7, 1921). F. Moor presents the following conclusions from the examination of the urine of 397 boys between eight and fourteen years of age at the Vauxhall Street Elementary School, finding albumin in 91 of the specimens (23 per cent.): (1) Intermittent albuminuria is a common condition among children. (2) It is not a form of kidney disease. (3) It is called by so many different names, and there are so many theories about it, that it is probably not a specific morbid entity but a symptom of several diseases - *Medical Record*.

## THE STUDENT'S REACTION TO THE TEACHING OF PEDIATRICS.\*

By ISAAC A. ABT, M.D.

Chicago.

Upon looking over the transactions of several years past, I found that the able and constructive addresses given by my distinguished predecessors before the American Association of Pediatric Teachers dealt exhaustively with the pedagogic problems of undergraduate and post-graduate instruction in pediatrics. So masterful and complete were these discussions, that it would be idle at this time to attempt to add anything new from the viewpoint of the teacher. It was but natural, then, that in casting about for material for this address, I should attempt a discussion of this subject from another angle, namely, that of the student's reaction to the instructor and the instruction. It was in the hope of throwing some new light upon the various aspects of instruction in this particular branch of medicine, that the investigation with which this paper deals was instituted, and I trust you will find the views as expressed by the student of sufficient interest and importance to warrant the presentation of this paper. I think it well that we occasionally take inventory of the student reaction to the mental pabulum which is dealt out to him, for, after all, the opinion of the student body reflects to a considerable degree, possibly far more than we ordinarily accord it, the digestibility of the intellectual food which is served to it in the annual grind of the medical school régime.

It must be conceded that the medical student who sits day after day in the class room before his various teachers has much to endure, many problems to solve, much to think about, and his daily toil is not inconsiderable. He realizes full well what his own limitations are, and what it is humanly possible for him to digest and assimilate. His reactions and opinions should not be disregarded, but rather should his reflections upon the value of medical instruction be taken into account by teachers in every degree and every department.

Students frequently pass judgment on the qualities of their

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\*Chairman's Address, American Association of Teachers of Diseases of Children, Boston, Mass., June 7, 1921.

teachers, and not infrequently the criticism is just and the praise is merited. They often idealize a teacher and hold him in the highest esteem. A young man who is studying medicine in a distant city, and who corresponds with me occasionally, sent me the following lines recently about Professor Blank who is the head of one of the scientific departments in a medical school. He says: "His lectures are very wonderful to me. Not so much the material he presents but the way he presents it. Whenever he gives a demonstration on an animal he looks at the record as though it was the first time the experiment had ever been attempted. He seems to see something beautiful and wonderful in each experiment, and he shows keen delight and enthusiasm in relating the story which describes the discovery of a certain drug. He can see the application of each phenomenon in its utmost use in clinical medicine, or the explanation of hidden scientific problems. His enthusiasm, energy, boyish spirit, and delight in some unforeseen discovery, intense interest in his problem, his wide knowledge and experience, his judgment in ruling out the unessential and stressing the big points, his careful and painstaking teachings, and his perfect conduct, never discourteous, rarely hasty, his deep sympathy for all living beings, seem to me to make him the most scientific and inspiring man I have ever met. I think he exemplifies the highest type of scientific spirit. The striking thing about his lecture is his method of presenting the subject. Each lecture is a gem. From this great teacher we receive inspiration and learn of what qualities a great scientist is made."

To lose sight of the reaction to instruction from the student standpoint would constitute a grave error in our teaching methods. With this view in mind I submitted the following questionnaire to my senior class at Northwestern University. The class numbers 70 members. They were requested to answer the various questions freely and without reserve, and also told that the inquiry included the teaching of pediatrics in the junior as well as the senior year.

The same questions submitted to the same class of medical students anywhere in this country would probably have elicited similar replies. Like students in an American school, the young men are in deadly earnest and take themselves and their voca-

tion seriously; they are sharp critics and whether they are always correct or not, they have very definite ideas about the value of their course of instruction. They appraise and grade the qualifications of their instructors. A teacher's reputation among his students depends upon the presentation of his subject. The students of a medical school value their teacher in proportion to the knowledge and inspiration they draw from him.

#### QUESTIONNAIRE.

1. Do you consider the study of pediatrics an important branch in the medical curriculum? Why?

2. In your estimation give the value of the following departments of pediatric instruction, and point out the shortcomings and advantages of each:

- (a) The dispensary clinic.
- (b) The recitation.
- (c) Ward walks and small clinics.
- (d) Clinical lecture to entire class.

3. Considering the large number of subjects which must be covered in the medical course do you think the course is allotted too much or too little time? In the junior year 80 of 1100 hours, and in the senior year 108 of 1142 hours are allotted to pediatrics.

4. From your standpoint, as a student of medicine, will you kindly answer the following:

(a) What qualities would you desire of an instructor which would indicate great efficiency and teaching merit?

(b) What in your judgment constitutes good clinical teaching?

(c) What constitutes poor clinical teaching?

(d) Can you suggest any method to eliminate waste of time in teaching?

(e) Is the teaching of pediatrics sufficiently correlated to scientific branches of medicine—chemistry, anatomy, physiology, pathology, etc.?

If a remedy is needed can you suggest it?

5. Point out the defects, if any, in our present method of teaching. In your opinion how large should pediatric classes be, and give reasons.

6. Offer, without reserve, any constructive suggestions or criticisms of the department of pediatrics.

7. Would you consider it an improvement in our teaching methods if students were required to do reference readings and present papers before the class?

8. Have you any criticism to make in our method of holding final examinations?

9. Is the instruction in infant feeding and nutritional diseases sufficient?

This inquiry relates to the teaching of pediatrics in the junior and senior years.

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In analyzing the answers to the various questions it will be possible to give only a summary of the replies received from the students. I shall attempt to make deductions from the various answers received.

*Do you consider the study of pediatrics an important branch in the medical curriculum? Why?* This question was inserted to get an expression of opinion from the students concerning the importance of this compared with other departments of instruction. The opinion was unanimous that the course was important and essential in the medical curriculum. Only one student thought that the course was not of major importance and should not be taught as intensively as medicine or surgery. In his opinion pediatrics should be studied as a specialty. All of the other replies were enthusiastically affirmative in favor of intensive instruction. One of the most complete replies which includes the various opinions is submitted verbatim: "I consider pediatrics important because it is a specialized branch of medicine, and the more or less empirical therapy as applied to an adult is not applicable to an infant or a child. The mechanism of a child is so finely adjusted and the balance so easily disturbed that special refinements of perception and judgment are necessary in the hygienic and dietetic care as well as in the diagnosis and the treatment of diseases of infancy and childhood. Ignorance or poor judgment can do irremedial damage in children, while the same methods applied to adults might cause much less harm. I think most students feel that a baby only needs to be fed milk until he has grown large enough to get everything else, and that if the baby falls ill he is to be considered a small adult without any special reference to his physiological, anatomical or pathological peculiarities."

Other significant answers are briefly summarized. Nearly all of the students agreed that the diseases of childhood had a bearing on the diseases of adult life, and they agree that many diseases acquired in infancy and childhood determine the future health and vigor of the individual's life. Not a few of the students point out that lowered infant mortality depends upon the attention paid to pediatrics in the medical school. A great many students, with an eye to future business, think that the young doctor may expect to have a large part of his practice confined to the treatment of sick children, therefore its importance. One student thought that pediatric instruction was the best possible training that could be given to a medical student because he acquires a greater degree of clinical acumen and acuteness, and for diagnosis he must depend largely on objective signs and also because of the careful attention to details of treatment and management in the care of sick children. The student is taught careful habits of work and if he would succeed he must avoid slovenliness and carelessness.

It seemed important to get the students' reaction to the various forms of instruction which are usually given in the clinical branches during the practical years. Therefore the second question was asked to elicit students' opinion on dispensary clinic, recitation, ward walks and small clinics, and clinical lecture to entire class.

It will be well to consider the students' reflections on these various branches of instruction separately.

Let us consider first their opinion on *the dispensary clinic*. The advantages of this form of instruction were enumerated as follows: The dispensary offers the best opportunity for study of diseases of children in their incipency. The student is taught how to obtain an accurate history, also a method of handling a baby as opposed to handling an adult. The student is permitted actual contact with the patient and is confronted with the problems he will meet in practice. One student stated that in the dispensary clinic he examines and studies a case and thinks of it as his own and is allowed to exercise his own judgment in the diagnosis and treatment, and also to invoke the experiences that he has derived from the departments of medicine in making a diagnosis. One student thought that the patients who were acutely ill were not



brought to the dispensary—this is, of course, an error, he evidently was unfortunate in not being in the dispensary at a season of the year when acute illnesses are frequent. Another student thought that the mental images which were obtained in a dispensary clinic were more permanent than those obtained from lectures, recitations or ward walks.

The dispensary clinic was subjected to some adverse criticism which may be summarized as follows: Some thought there was too much clerical work or history taking in the dispensary. Nearly all the students suggested that they be allowed more time in examining cases themselves, and not a few thought that the dispensary exercises should be given during the senior year, and that lectures and recitations should be given during the junior year. Others thought that the time allotted to dispensary exercises was too short. A few considered that too many cases came to the dispensary to permit efficient work. All the students demand that the dispensary instructor should be punctual and should give his time and attention to the instruction of the student as well as to the care of the patient. This is not unreasonable.

The replies to the inquiry concerning *the value of the recitation* were very much mixed. Many of the students agree that the recitation provides for intensive study, and is a valuable introduction in acquiring the fundamentals of the subject. A number point out that only one student is working at a time. One man declares that oral recitations are a waste of time. As conducted by the ordinary instructor, the class as a whole shows little interest, and the individual student's mind wanders or he actually goes to sleep, while his fellow is reciting. In another reply we are informed that the first 10 minutes of each hour should be devoted to quizzing, and the balance of the hour to clinical lecture or demonstration of patients to small groups. Others think that the recitations enable the instructor to point out the shortcomings of the student. Many of the replies convey the idea that the classes are too large to permit the instructor to quiz the men frequently enough. A student should recite at each meeting. Another student says that recitations do not appeal to him, and thinks that it is a loss of time. He finds that most quiz instructors have a tendency to dwell on minute details. He admits that under a competent instructor, the recitation may be made a whip, though he

questions the value of memorizing details and numerous isolated facts. He concludes that the knowledge acquired in the recitation enables the student to answer questions and pass examinations; though he has serious doubt about the permanent value of the information which is obtained in this way. One man sums up his opinion in the following epigrammatic way: The recitation is a relic of ancient pedagogy and is a form of didactic parroting. In 2 instances the students presented their estimate of the comparative value of the various forms of instruction on a percentage basis. The first one classifies the instruction as follows:

Dispensary clinic .....	30%
Recitation .....	5%
Ward walks and small clinics.....	15%
Clinical lectures .....	50%

Another student arranges his percentages somewhat differently:

Dispensary clinic .....	30%
Recitations .....	20%
Ward walks .....	10%
Clinical lectures .....	40%

This summary leaves us somewhat in the dark as to the students' valuation of the recitation. While its value in some instances is recognized, it apparently does not stand high in the estimate of the student body.

*Ward walks and small clinics.* The general opinion among the students was that the ward walks were efficient methods of teaching. Indeed, most of the replies suggested that more ward walks should be given and that the classes should be divided into small groups. One student says that the ward walk permits freedom of thought and expression on the part of the student. In the large clinics the students are intimidated by their friends; they are as much afraid of being right as of being wrong and consequently they refrain equally from answering questions or asking them. They have a dread of being in the spotlight. In a small clinic this element is eliminated, and the relationship between student and instructor is informal. One student thinks that in teaching small groups the instructor is not as well prepared as he is for larger classes. All the students are agreed that the ward walk is one of the most valuable means of teaching diagnosis and treat-

ment of disease. They are unanimously of the opinion that students should be allowed to examine the patients and follow the course of their illness, also that the instructor be given more time for individual teaching. Several students emphasized the point that in ward walks the acute infectious contagious diseases of childhood are most advantageously studied.

*Clinical lecture to entire class.* In recent years there has been considerable discussion among medical teachers as to the value of the large amphitheatre clinic. An analysis of our replies seems to indicate that the majority of the students favor the clinical lectures before the entire class, though of course, as would be expected, there are some objections and there is some criticism. One reply gives many of the points which seem to express the feelings of the students who favor the large clinic. He says that he considers the clinical lecture to the entire class essential. Such lectures should be conducted by a leader and an authority who has the instincts of a teacher. It should be possible for the teacher in this large clinic to correlate the knowledge which the student has acquired, to help him separate the wheat from the chaff and to direct his professional ideals. He should be able to mould into a concrete whole the mass of material which the student has collected in the dispensary, recitation room and from other sources. The moulder of men must be a master. The students demand that he should add the finishing touches; without this they would not be satisfied with their medical training. Other students think that the instructor of large classes gives more preparation and time to the clinics than he would for smaller groups, also that clinical lectures save time and furnish an opportunity for the presentation and discussion of a large variety of cases during the course of the year. One student replies that the clinical lecture is a success or a failure, depending upon the ability of the instructor.

Some of the adverse criticisms upon the clinical lecture system point out that the instructor does practically all the work and consequently the facts contained in the lecture or demonstration are not impressed sufficiently upon the student's mind and are soon forgotten. Another student points out that quizzing about special points during the hour should be eliminated because it is a waste of time. One student finds fault because the teacher occasionally reads abstracts from the medical journals or quotes series of

statistics. Several of the students thought that one of the defects of the clinical lecture was the lack of opportunity given to the students to examine the patients thoroughly. Another student thinks that the medical house officer should not read the history because he reads too rapidly and does not stress the most important points.

These replies indicate that students are many-minded. They obtain their information in different ways and until the millennium it would not be possible to teach medicine or any other subject to the satisfaction of all. Nevertheless, the majority of the students declare that they profit by the clinical lecture.

In order to ascertain whether the students felt that they were having a surfeit of pediatric teaching, or whether they were being slighted in this direction, the next inquiry was made.

The students of the junior year are given 80 hours of instruction out of a total of 1100 hours, and in the senior year, 108 hours out of a total of 1142 hours.

In the majority of instances the students' replies indicate that the time allotted is sufficient. One student thinks that at least 120 hours should be devoted to pediatrics in the junior year, though, on account of the crowded curriculum, in the senior year 108 hours are sufficient. Another thinks that the recitation in pediatrics should be given in the sophomore year and that more small clinics and dispensaries should be offered in the junior year. One of our students facetiously remarks that he does not see how much time could be devoted to pediatrics unless the number of years of the medical course were increased. Another student would take an hour and a half period weekly from surgery or medicine and devote it to pediatrics. Another thinks that the time allotted would be sufficient if the medical text-books were condensed. He thinks that the information is too minutely presented to be absorbed by the student. Furthermore, the essentials should be well studied and the non-essentials eliminated. He finds that the professor of a non-essential subject tries to make specialists out of all senior students. Such a method results disastrously and leads to poor scholarship.

In order to obtain the viewpoint of the student upon the general qualifications of teachers, and also on the quality of the teach-

ing, and the technique of teaching methods the following questions were introduced:

*First, what qualities would you desire of an instructor which would indicate great efficiency and teaching merit; what in your judgment constitutes good clinical teaching?* In replying to these inquiries the students show a fine discrimination and their viewpoints are unique and are not commonly considered in the professorial discussions. Most of the students demand that the teachers have personality, sufficient to hold the interest and attention of their classes, through which they would gain the confidence and respect of the students, and in turn should show them consideration. One of the students goes so far as to say that informality is the outstanding and predominant characteristic that makes teaching efficient. The faculty and the students should be linked together in splendid comradeship. The student's opinion should receive consideration, his questions should be weighed and passed upon without any attempt to belittle or sneer at him. The students cannot tolerate sarcasm on the part of the teacher and they confess freely that they are intolerant of egotism or overbearing manners.

The student wants an opportunity to propose questions to the teacher and he thinks that the teacher should have the student's viewpoint. He should be polite, he should not "bawl out" the student because the latter asks what seems a foolish question to the teacher. The average student is anxious to learn, and, although the question asked may seem trivial and irrelevant to the instructor, it is often very important from the student's standpoint. Nothing will stir up the antagonism of the individual student (the whole class is with him) more than the ridiculing of a question by the instructor.

The replies also indicate that the teacher should show a desire to teach, that he should know his subject, that he should present the matter under consideration in a clear, forceful manner, that his presentation should be simple, concise, logical and that he should avoid meaningless statistics and useless repetition. The students are not interested in a lot of wild and unknown theories. They think that the teacher should give each clinic some forethought and preparation so that all of the essential, important material may be massed together in a ready and orderly presentation.

A well prepared clinic is left in permanent form in 70 students' note books. The student wants to write his lectures down in outline form.

One student tells the following anecdote: Paganini when questioned about his genius for the violin remarked that it was one per cent. inspiration and 99 per cent. perspiration. The teaching genius is probably no exception to this rule.

There are several other qualities which the students would desire of an instructor indicating his teaching efficiency: He should be sincere, he should have a pleasing delivery, which need not be oratorical. He should make a clear, definite presentation of his case, giving emphasis to the outstanding features and he should lay stress on those details which pertain pointedly to the subject under discussion. He should make a logical, thorough presentation and arrive at a reasonable conclusion. He is warned, however, that he should not make claim to infallibility, because the student feels that in spite of his real or apparent greatness he is one of the mortals and a percentage of error must occur in the experience of the mightiest.

The teacher is also told that he must appear as a gentleman; he should be well washed and well groomed, he should dress neatly and have the manner and the bearing of a physician. He should not dwell on hobbies. He should use good English. He is also told that he should present the more common cases, not the most unusual ones. Thoroughness and repetition are good pedagogic methods, and consequently important points may be emphasized and repeated in order to drive them home to the student. He should have a wide clinical experience which would necessitate his being a man of middle age. Younger men probably have the students' viewpoint better than the older men and are well regarded by the students, though our young friend regrets to see men retire from teaching service at a time when their services are most valuable and most appreciated, when their experience is ripened and when they can teach most successfully. There are many more valuable suggestions too numerous to mention, which for want of space and time must be omitted. A large number of the replies contain this admonition: Begin and close the lecture on time!

*What constitutes good clinical teaching and what is poor teaching?*

These first 2 points may be considered together. The replies seem to indicate common agreement on certain points. The students think that poor clinical teaching is manifested by too many patients being shown at one clinic, and by lack of preparation of material. It is a strange thing that so many students complained about the repetition of material. A certain amount of repetition should be advantageous in teaching because it emphasizes and drives home the points, and facts elicited in this way should be less easily forgotten. The students insist that they want the practical side of cases concretely stated. They object to too much quiz work in the clinic. They think that occasionally there is too much discussion over non-essential points. They are emphatic in demanding that a teacher should have experience and declare that the clinic is poor when presided over by an instructor of inferior training and in whom the students have no confidence.

They also say that the poorest kind of instruction results when the teacher attempts the "riding" and ridicule method in order to impress the student's mind. They also ask that long orations be omitted, and that brilliant dissertations be excluded. The latter may sound logical to the specialized instructor, but the ordinary student cannot follow the line of thought which is involved because too much is taken for granted. The instructor is informed that it is poor clinical teaching to ask questions beyond the scope of the students' knowledge.

*Concerning the query to eliminate waste of time* a considerable number of the replies stress the point that rare and unusual cases are not the most desirable. They would prefer to see the ordinary cases thoroughly explained. The instructor is given this piece of advice—avoid resurrecting and recrucifying the subjects; when you have made your points, discussed your case, when you are through with your argument, cease talking.

Practically all of the students agree that there is sufficient correlation of pediatrics to the other scientific branches.

Questions 5 and 6 brought out no startling criticisms. Many of the students expressed the viewpoint that the classes in practical instruction should not be large so that the students themselves could come in actual contact with patients, and consequently be allowed to follow up cases. Some think that there should not be more than 10 to 12 students to a section and more ward walks

should be provided. Several of the students expressed the view that the older and experienced men of the faculty and those with some reputation in the clinical branches should meet the classes somewhat earlier in the course than they do now. They think that it would be an advantage to meet them during the third year so that they might sit at the feet of the professor and imbibe from him wisdom, inspiration, dexterity and technique. One student is quite emphatic in saying that the head of the department, or professor, should give his instructions to the entire class, while the associates should meet the sections of the class.

Another ambitious young man suggests that the members of the class should be permitted to do out-patient practice in the homes so that they may get more practical experience.

Questions 7, 8, which refer to the presentation of papers before the class by the students, did not meet with much favor. Various sentiments are expressed. One student thinks the plan is good enough and is beneficial for the student working on the paper but is of no benefit to the class. Other opinions are that the student does not have sufficient time out of class to prepare a paper worth while. The class wants to be taught by the instructor, not by the student. Another opinion states that a student who prepares a paper lacks the experience and the ground-work necessary to interpret and stress the essential points. The thought is expressed that the student would go to sleep when a mere classmate is reading a paper.

The majority make the point that the individual student and not the class would profit by this method of instruction. Only very few students are in favor of this form of exercise.

Another student recognizes the value of reference reading but he thinks there is insufficient time in the senior year for this kind of work.

The next question deals with the method of holding final examinations. Most of the students think examinations should be abolished as far as the last term of the senior year is concerned. They feel, however, that the examinations in the junior year are essential. There are numerous suggestions. One critic of the examinations thinks that students' records throughout the years should decide their standing. Another thinks that the examinations are too long. One reply states that an examination is not a



fair test of a man's knowledge. Many similar reasons are expressed. Very few have a kind word for examinations. One man even thinks that examinations are demoralizing to students.

The next question refers to the instruction in infant feeding and nutritional diseases. Many students think that sufficient time is given this branch. All agree that it is an important branch of the subject and should receive ample consideration. There are various suggestions as to how infant feeding should be taught. Some advise more didactic teaching, others suggest practical instruction in food preparation, while others think that the subject should be taught in small clinics and infant welfare stations.

From this mass of evidence which has been presented no dogmatic deductions should be drawn. When the evidence is carefully weighed we find that students express an unanimous opinion on some points and that they are at variance on others. It is a principle in education, expressed long ago, that the learner learns to do by doing. Our students emphasize this point in almost every instance. They want to examine the patients because in this way they obtain the practical experience and acquire definite knowledge which impresses itself on the men. They leave no ambiguity in the minds of those who read their answers to the inquiry; in every instance they evaluate the teaching and the teachers. They make us feel that a modern medical school does not depend upon the buildings and equipment alone, nor upon the hospital facilities, but more upon the methods which are employed for imparting knowledge. A great and efficient medical school is as great as its teachers, for in the students' judgment nothing else can compare with teaching efficiency.

There may be those who think that the student opinion is not sufficiently mature to pass final judgment upon these very important points at issue, and who also think that the students do not know what is best for them, and who would place little value on the answers which are the result of this questionnaire. One cannot fail, however, to appreciate the earnestness, the intelligence, and the fine discrimination which these students have shown in answering this inquiry. A teacher who will carefully and thoughtfully study these answers may, in some instances, be enabled to improve his teaching quality and his efficiency. At any rate, he will find therein much food for reflection.

## INSTRUCTION IN THE INTERPRETATION OF LABORATORY TESTS.\*

By A. LEVINSON., M.D.,

Chicago.

Anyone who is acquainted with the curricula of our medical schools will admit that there is too little correlation between the laboratory instruction given in the premedical and early medical course and the clinical instruction given in the latter part of the medical course. When the student enters upon his clinical studies in the last 2 years of his course, he usually discards the laboratory teachings he has learned as useless, because he does not see the application to the living patient of the many methods and tests he has learned in the laboratory. The clinical instructor, who is wide-awake, does not fail to "bring in" the laboratory work when he presents his cases, but because of the many points in the history and symptomatology of the cases that call for explanation there is not always sufficient time left for the interpretation of the laboratory tests.

That the average physician, the recent graduate as well as the old practitioner, is not familiar with the interpretation of tests, laboratory workers can testify. They are constantly being asked by physicians for "complete blood" or "complete laboratory work," and on furnishing the complete report they are again asked to interpret their results. On the other hand, there is another extreme toward which some physicians, especially young graduates, are tending, namely, the placing of the laboratory tests above all clinical signs and symptoms. The danger of such an attitude becomes evident when a special laboratory test, such as a throat culture, proves negative. We all know how frequently it happens that a culture in a case of diphtheria, in spite of all clinical signs pointing to a diphtheria, is negative. It has often occurred to me that a course discussing both the value and limitations of laboratory tests in their relation to clinical material would meet a vital need in the curriculum of the medical school.

Through the kindness of Dr. Isaac Abt, head of the Department of Pediatrics of the Northwestern University Medical School,

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\*Read before American Association of Teachers of Diseases of Children, Boston, Mass., June 7, 1921.

I was permitted and even encouraged to give such a course in the interpretation of laboratory tests. During the past 2 years I have presented the course to 4 different classes and it has worked out quite satisfactorily.

The course, as I gave it, deals with the interpretation of laboratory tests as applied to pediatric practice. It does not aim to teach the student how to perform the tests. It is taken for granted that he has learned that during his freshman and sophomore years. The course only teaches the student the interpretation of the most important tests and their application in pediatrics. In studying the blood, the value and limitations of leucocytosis, of relative lymphocytosis, of blood sugar, non-protein nitrogen and urea, of alkali reserve, Wassermann, blood culture and blood grouping are discussed. In studying the urine, the value and limitations of albuminuria, reduction tests, cells, casts, quantitative chlorides, total nitrogen, urea, uric acid, ammonia and kidney function tests, are discussed. Cerebrospinal fluid, milk, stool, and pleural exudate, are studied in the same way. The interpretation of skin tests and of x-ray are also discussed.

A case is presented at every lecture and the tests previously done are interpreted and compared with the clinical findings. Occasionally, difficulty arises as to what value should be attached to certain laboratory results. It is a well-known fact that various workers attach different values to certain tests. Such, for instance, is the case with indican and creatinine in urine, and the fragility of corpuscles in the blood. In such cases I make it a point to tell the students that there is a diversity of opinion as to the value of the test, and that it is on the clinical findings, coupled with the laboratory tests, that a decision should be made.

Although it is my policy not to discuss technique with the students, I find that it is advisable every once in a while to outline or to discuss briefly certain methods of obtaining the specimen. This has been done in cases that call for special methods on account of the age of the patient, such, for instance, as the method of obtaining blood or urine from infants.

The following outline covers the subjects discussed during the course :

*Blood.*

- |   |                                   |
|---|-----------------------------------|
| 1. Number and type of cells in the blood of infants and children. | 5. Acidosis as detected in blood. |
| 2. Hemoglobin.  | 6. Blood Wassermann.              |
| 3. Coagulation of blood.  | 7. Blood culture.                 |
| 4. Blood chemistry.   | 8. Blood grouping.                |
|   | 9. Agglutination tests.           |
|   | 10. Fragility of corpuscles.      |

*Cerebrospinal Fluid.*

- |                        |                                   |
|------------------------|-----------------------------------|
| 1. Amount.             | 7. Decreased chlorides.           |
| 2. Pressure.           | 8. Lange curves.                  |
| 3. Color.              | 9. Wassermann.                    |
| 4. Pellicle.           | 10. Agglutination.                |
| 5. Increased globulin. | 11. Findings in various diseases. |
| 6. Decreased sugar.    |                                   |

*Milk.*

- |                         |                           |
|-------------------------|---------------------------|
| 1. Physical properties. | 3. Bacteriological tests. |
| 2. Chemical properties. |                           |

*Stool.*

- |                         |                           |
|-------------------------|---------------------------|
| 1. Physical properties. | 3. Bacteriological tests. |
| 2. Chemical properties. |                           |

*Urine.*

- |                        |                           |
|------------------------|---------------------------|
| 1. Qualitative tests.  | 3. Kidney function tests. |
| 2. Quantitative tests. |                           |

*Pleural Exudate.*

- |              |                  |
|--------------|------------------|
| 1. Color.    | 3. Cell content. |
| 2. Sediment. | 4. Bacteriology. |

*X-ray.*

- |                                     |                               |
|-------------------------------------|-------------------------------|
| 1. X-ray of chest.                  | 3. X-ray of bones and joints. |
| 2. X-ray of gastrointestinal tract. |                               |

*Skin Tests.*

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|----------------|-------------|
| 1. Tuberculin. | 3. Luetin.  |
| 2. Schick.     | 4. Protein. |

*Miscellaneous Tests.*

- |                      |                             |
|----------------------|-----------------------------|
| 1. Epinephrin.       | 4. Electrical excitability. |
| 2. Sugar tolerance.  | 5. Mental tests.            |
| 3. Basal metabolism. | 6. Ophthalmoscopic test.    |

## THE CHILDREN'S CLINIC OF THE FUTURE.

By IRA S. WILE, M.D.,

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The term "clinic", philologically considered, refers to the bed-ridden. In general terms, it is a place where medicine and surgery are taught at the bedside or in the presence of the patient. This concept is inadequate for the future, in that more attention will be placed upon instruction concerning the methods of escaping the need for either medicine or surgery. The connotation of the term clinic will thus have to be extended so as to include the idea of classes in public health and hygiene leading to the conservation of health as well as to the methods of regaining departing vigor or of overcoming handicaps and defects already existent.

A child, according to the lexicographer, is an offspring of any age less than maturity. This view of childhood is broad and will be accepted in the consideration of the Children's Clinic of Tomorrow.

It will be admitted at once that the main characteristics of children are biological, psychological, and social, but these are not dissociated in the organism, but are interwoven in the fibres of being so that to consider any one or treat him in any way requires consideration of the entire child. The future will stress not merely the physical phase of childhood, but also the mental and moral factors and will not omit to give adequate attention to the problem of social adjustments, out of which arise the dominating influences of character formation.

The future children's clinic will be organized on a basis of preventive medicine with, however, adequate stress upon its therapeutic phases. There is such a thing as prophylactic therapeutics, as, for example, the administration of mercury and arsphenamine in the treatment of the child-bearing woman to safeguard the potential child against syphilis. The removal of diseased tonsils comes in this same category as a method of lessening the likelihood of rheumatic infection, chorea, or cardiac disease. The significance of prophylactic therapeutics will be emphasized in the future, in that more thought will be given to the threatening interference with child development without any lessening of considera-

tion of any particular disease or defect of an acute or sub-acute nature. As a converse thought, there is also what may be termed therapeutic prophylaxis, that is, the stressing of advice concerning hygiene and education in such a way as to accomplish curative affects without the use of any medication. This is well illustrated in our present methods that are employed in cardiac classes, nutritional classes, and physical exercise drills, etc. The emphasis placed upon education in hygienic living will be increased for its potential therapeutic results in the face of incipient disease or threatening or potential complications.

The future children's clinic will continue to recognize the child as an individual, but will not view him dissociated from his family setting. His physical, mental and social development depend upon his environment even more than upon his heredity in so far as his wholeness, health and sanity of being are concerned. For this reason the clinic of the future will aim at continuity of influence over developing childhood through an activation and stimulation of home responsibilities with guidance and supervision.

The future clinic will, in fact, constitute a center of child welfare having departments dealing with the problems of pre-natal life, infant welfare, the various problems of the pre-school age and further linked up with school and industry as may be required to meet the specific conditions calling for attention during this period of the development of childhood. It will serve as a receiving and distributing center for all types of service, including problems ordinarily designated as medical, surgical, dental, psychiatric, and nutritional. It will embrace problems of nursing, social service, and coöperation with existent agencies interested in the welfare of childhood. In short, it will serve as a center for promoting welfare in terms of the individual child, the family, and the social relations. Far more attention will be given to the problems of educational and social maladjustments than enter into the plans of existent children's clinics. The importance of mental hygiene will be more clearly recognized and an adequate effort will be made to understand the mental and moral disease factors, responsible for the various difficulties, now ordinarily classed under the head of delinquency, misconduct, defectiveness and juvenile psychopathy. There will be far greater thought given to the adjustments during the pre-school age and to the portentous problems of adolescence

than now obtain, and this holds true for physical conditions, though less so than for mental and social conditions.

With this conception of the unity of childhood, it is patent that the clinic of the future will attack the health problems of childhood on a basis of more than mere anatomy, physiology, endocrinology, psychology, and pathology. It will deal in terms of potentials, functions, personality, conduct, environment, heredity, economic status, dietary, spirituality, education and adjustments. The basic point of view will be in terms of human relationships, social responsibility, and future efficiency in a world of effort where perfection is rare and adjustments are constant. It represents a revised estimate of the purpose of clinics in relation to the communities they are to serve. It will symbolize the adaptation of socialized medicine to the needs of childhood.

I have not dwelt upon pediatric clinics as at present constituted because they are in a state of transition. The influence of preventive medicine is altering the character and purpose of their efforts. The stress upon the acute ambulatory conditions that gave rise to such large pediatric services has not declined, but the efforts at preventive work have caused great changes in the nature of conditions receiving treatment. No longer are the benches occupied by the serious gastrointestinal disorders of infancy or the fistulous glands of the scrofulous. The vicious infections of the mouth are as rare as the obsolescent scurvy. Despite epidemics there is a decline in the acute contagious diseases and parasitic infections.

Though dispensaries have been popularized, the clientele among children presents no great mass increase, while the variety of afflictions is increased only by reason of greater accuracy in diagnosis and an improved classification of pathologic states. Obviously, all that existent maladies require in the nature of diagnosis and treatment will be available. There will be laboratories, x-rays, electrocardiographs and similar mechanical and chemical aids, essential for refinements of diagnosis. Treatment will be more individualized and less formalized and will take advantage of such assistance as may be given in the home by district nurses, visiting dietitians, and social service workers.

There will be a more careful system of record blanks adequately kept and filed not merely for statistical purposes but to indicate

the history, treatment and general progress of the children during their period of development under the guidance of the clinic staff. The clinic secretary will exist with a real service to perform beyond the simple history taking. There will be but one general record for each child with the necessary special notations from every department or agency it may consult. The attitude toward the whole child will carry over into its record instead of parts of its history being scattered in various special departments.

The follow-up work will be of major importance and thus serve to continue the relations between the child and its family with the children's clinic. The fullest scope of this service is admittedly essential and its protean development cannot be forecast save in so far as one may say it will be thorough, painstaking, sympathetic, and understanding.

It is not unlikely that provision will be made for the continued oversight of children, from conception to maturity with a view to conserving the living assets of the state for the benefit of the body politic as well as for the personal protection and nurture of the individual child. An enlarged personnel will come into being, involving not merely the doctor, the nurse, and the social visitor, but the dietitian, the home maker, the dentist, the oral hygienist, the psychiatrist, and the socialized pediatricist. The immediate staff will function at the clinic and in the home and through various special departments of dispensaries and hospitals, convalescent homes, recreational centers, schools, courts, special institutions, for handicapped children and those suffering from incipient diseases. Their activities will be linked firmly with all medical, social, industrial, probationary, and relief agencies; in short, with all organizations, institutions, and agencies, public, semi-public, and private, that concern themselves with child welfare.

While a clinic of this character, preferably, should be a part of the organization of a general hospital and its out-patient department, it is not essential for its success save in such communities where the general hospital forms the center of all forms of medical activities. In rural organization numerous problems suggest themselves which, however, need not be discussed at this time. This larger vision of pediatric service will not be content to allow the existence of a pre-natal clinic, a baby welfare station, a pre-school age clinic, a cardiac class, a nutritional class and similar agencies of



the present time as unrelated and independent units, but will insist upon their coördination and unification in a single center as more properly reflecting the idea of harmonious, balanced, concentrated, and intensive work for children.

When complete articulation with hospitals, schools, recreation centers, and special institutions of all types is impossible it will be essential to establish an internal service of a few beds where children may be held for observation, physiological study, and psychiatric investigation for diagnostic purposes. Under these conditions, too, it will be necessary to make various additions to the basic plan in order to make possible the special treatment that is imperative. These details need not be enumerated as they depend upon the particular needs of the community to be served and the problems that are most likely to arise. It is practically impossible to establish a perfect institution prepared to cope with every problem of childhood that may arise, but foresight may provide against the neglect of the commonest handicaps.

The future clinic will partake of the nature of a general clearing house for all conditions affecting childhood. Its relations will be centrifugal to all organizations focussing their thought upon child welfare. The centripetal influences will delve into the child itself in order to determine the essential elements requiring correction, modification, or cultivation. The child will be the center of thought, but the sphere of influences affected will be the child's world. The experience of the past and the lines of development of the present indicate the necessity for a further transformation of our working plans, so that our accomplishments in the future may be limited only by our knowledge; and through the growth of research into child activity the field of endeavor will be broadened and the success of accomplishments will be extended. Childhood will then come into its own in so far as it is humanly possible for any clinic to encompass the necessities and progress of child welfare.

*264 West 73rd Street.*

## WOUND DIPHThERIA RESPONSIBLE FOR A DIPHThERIA OUTBREAK.

By ALBERT D. KAISER, M.D.

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The purpose of reporting this outbreak of diphtheria in a general hospital is to demonstrate the need of culturing wounds as well as nose and throats in endeavoring to find the carriers.

The first 2 cases of this outbreak were mild, tonsillar type occurring in nurses. One of the nurses had been on duty in the surgical ward and the other was the night superintendent who regularly visited this ward. A few days later 2 children from the children's ward developed clinical diphtheria. Inasmuch as their admission cultures were negative it was assumed that their infection was due to some carrier outside of the children's ward. There was considerable diphtheria in the city at this time so this inference seemed warranted. However, the 30 children were recultured and in 8 children the Klebs-Loeffler bacilli were found in throats that were negative on admission. When a third nurse, who had been in charge of the Dakin's dressing cart in the surgical ward, was reported to have a laryngeal obstruction which turned out to be laryngeal diphtheria, all the nurses were cultured as they had been some months previous. Five carriers were found among them. When all carriers were isolated and no new patients were admitted either to the children's or adult's wards unless negative throat cultures had been obtained, it was hoped that this outbreak would terminate. The Schick test was done on all nurses and immunization was brought about in the positive cases. No new clinical cases appeared among them. It is interesting to note that 2 of the 3 nurses who developed clinical diphtheria had never been Schicked while the third one had a positive Schick test, but had never received toxin-antitoxin mixture. All children were actively immunized, but from the adult ward 3 more clinical cases appeared all of whom showed negative cultures upon entrance. Attention was then focused upon this ward instead of the children's ward. Repeated throat cultures brought to light additional carriers among the adults, but the real focus had not been found.

At this time attention was focused upon a 16-year-old girl in the surgical ward. She had been admitted a few days prior to the first cases of diphtheria with a diagnosis of empyema. She had little relief from the operation and her general condition was further impaired by repeated small hemorrhages through the incision. Though free drainage was established there was no drop in temperature and the patient soon presented a picture of toxic absorption. In changing the dressing one day the attending surgeon noticed a dirty grey exudate about the tubes. Smear and culture showed typical Klebs-Loeffler bacilli. The girl was immediately given 18,000 units of diphtheria antitoxin intravenously and transferred to the contagious pavilion. There was a drop in temperature the following day with apparent improvement, but death followed a few days later from cardiac failure. Necropsy revealed a marked membranous pleuritis and pericarditis. A tough membrane could be stripped off the pericardium. Smears and cultures from the pleural and pericardial membrane, as well as the pericardial fluid, showed typical Klebs-Loeffler bacilli and these organisms were also found in the above mentioned tissue when stained. There was considerable difference of opinion as to whether the empyema wound was secondarily infected or was it a primary diphtheritic pleuritis.

However interesting the clinical aspect of this case may be it had greater significance from the standpoint of epidemiology. A review of the early cases of diphtheria showed that they had been in contact with this girl after her operation. The nurse who developed laryngeal diphtheria had been doing the dressings on the empyema wound and was also in charge of the dressing cart which was taken to the children's ward. The regular occurrence of new cases was undoubtedly due to the discharging wound for as soon as this case was removed no new cases developed and the diphtheria outbreak came to an abrupt end.

The difficulty experienced in checking this epidemic until the surgical case infected with Klebs-Loeffler bacilli was found demonstrates the necessity of culturing, healing or discharging wounds as well as the nose and throat when attempting to discover the focus of infection.

## CLINICAL DEPARTMENT

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CASES CONTRIBUTED BY

C. G. KERLEY AND E. J. LORENZE, JR., GAYLORD W. GRAVES AND

GEORGE R. IRVING,

New York.

CASE No. 15.\* Male, 13 years old.

*Family History.* For many years his mother had been troubled with pain in her joints, but no definite history of acute rheumatic fever could be obtained. The father had been under treatment for hyperchlorhydria for several years. One sister is well and the other is subject to frequent attacks of indigestion and recurrent urticaria.

*Personal History.* Third child, full term, normal delivery, birth weight  $8\frac{1}{2}$  pounds. He has had measles, whooping cough, chicken pox, diphtheria and scarlet fever. Three weeks after the onset of scarlet fever, an acute nephritis developed, his eyelids became edematous, albumin and casts were found in the urine. At this time he was confined to bed for a period of 8 weeks. Upon frequent occasions his urine was examined and it was not free from albumin and casts until 3 years later. He was breast fed until he was 9 months of age and made splendid progress until weaned. There was considerable trouble with cow's milk feedings.

His first attack of colic occurred when 7 years of age. He complained of excruciating pain in the lower abdomen which persisted throughout the night in spite of the treatment employed. He cried constantly and was unable to sleep. No vomiting occurred and the pain disappeared spontaneously the next morning. During the following 4 years similar attacks occurred. Seldom was he free from severe attacks for more than 3 or 4 months. Pain in the lower right quadrant, the predominating symptom, made its appearance as a rule 2 or 3 hours after eating, but at times he would be suddenly awakened during the night, at other times the pain would occur immediately before his meals. The mother noticed that the attacks were most fre-

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\*Severe paroxysmal abdominal pain, and anorexia.

quent after holiday meals or dinner parties. The pain was always located in the right lower quadrant and did not radiate. So definite was the localization of the pain that numerous physicians had made the diagnosis of appendicitis. On several occasions operations had been recommended. The severity of the pain at times was such that the boy writhed and fell to the floor. The attacks during the following 2 years were more severe and occurred every 2 or 3 months. In the last 9 months the seizures have occurred every 2 or 3 weeks with pain persisting for hours and being much more severe in character. Vomiting never occurred but he frequently suffered from nausea. During the attack his face becomes pale and his lips cyanosed.

*Physical Examination.* Weight 92½ pounds, height 59½ inches, general condition very good, muscles were well developed, skin clear, bony structure apparently normal. The head was normal in size and shape, pupils reacted to light and accommodation, and the conjunctiva was normal. Nose, mouth and throat clear, tonsils and adenoids had been removed, tongue slightly coated, teeth in good condition. Breath slightly foul. The thyroid was not enlarged and the lymphatic glands were not palpable. There was a slight impurity of the first sound of the heart, and the muscular quality was good. Lungs normal, the abdomen was slightly distended, liver not enlarged, spleen and kidneys not palpable.

*Urine Examination.* Entirely negative.

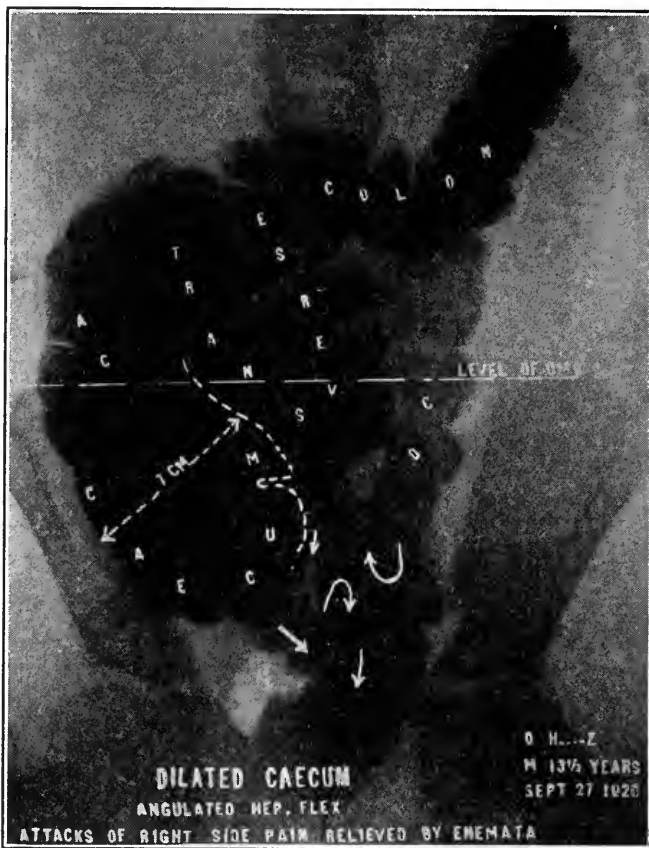
*Blood Examination.* Normal.

Because of the abdominal distention, the absence of pain in the abdomen upon manipulation, and the absence of muscular rigidity, together with the location and colicky character of the attacks, a diagnosis of dilated cecum or ascending colon, or both, was made. The patient was referred to Dr. LeWald at St. Luke's Hospital for x-ray examination:—

*Roentgen Examination.* The stomach, though ptosed (greater curvature 1½ inches below the umbilicus), is emptying at a fair rate. At 5 hours, 10 minutes the stomach is empty. The coils of the small intestine are rather prominent. There is stasis in the right half of the colon. At 48 hours traces of the meal remain in the cecum and appendix. The appendix appears to pass be-

hind the cecum. At 69 hours all traces of the meal have been eliminated.

Bismuth injection of the colon. There is marked redundancy of the sigmoid, transverse colon, hepatic flexure and especially of the cecum. The cecum hangs down into the true pelvis and



is so large (transverse diameter 7 cm.) that its shadow overlaps that of the sigmoid flexure and passes slightly to the left of the median line. The transverse diameter of the ascending colon indicates some dilatation and irregularity suggesting the possibility of adhesions in this region. Twenty-one hours after injection there is still some of the opaque substance in the cecum and appendix.

**SUMMARY.** The most prominent findings relate to the dilatation of the cecum with the possible presence of congenital adhesions in the region of the hepatic flexure.

The boy was given a simple, plain diet, suitable for his age, with 5 hour intervals between meals. Three ounces of liquid petrolatum were given at bed time.

It was evident that there was a persistent over-loading of the intestinal tract with an accumulation of waste or undigested food-residue habitually in the dilated cecum. This, with the formation of gas and the mobility of the cecum to evacuate, because of the sacculation in the transverse colon, was the cause of the attacks of colic. We have found that liquid petrolatum is extremely useful in proven cases of sacculation, dilatation and angulation of the gastrointestinal tract in children. He had been free from attacks of colic for the 12 weeks under the above management.

CHARLES G. KERLEY AND EDWARD J. LORENZE, JR.

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**CASE No. 16.\*** Female, 11 years old.

Although it is not within the sphere of pediatrics to trespass far in the domain of neurology, it is nevertheless incumbent upon those who observe children most constantly to recognize the incidence of neurological disease and to identify the juvenile neurological diseases promptly. In the case here presented the abnormal signs and symptoms are of such short duration and yet so typical that they seem worthy of record as exemplifying the need for the more general employment of the simpler neurologic tests in routine examination of children.

*Case Record.* The patient is a girl 11 years old. Her mother died from carcinoma. Her father and a sister, 10 years old, are in good health. There has been available no definite record of disease in the family, that could have a bearing upon the case. The patient's own history is negative except for the occurrence of chicken pox, otitis media and influenza. Recently she has lived in a suburban town, attended school, and until the onset of the symptoms to be described, enjoyed apparently good health.

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\* Friedrich's ataxia. Illustrative case presenting the early manifestations. Case presented before the Section on Pediatrics, New York Academy of Medicine, February 10, 1921.

About December 20, 1920, she became mildly ill with nausea and abdominal pain which was annoying only when she moved about, was not accompanied by vomiting or diarrhea, and subsided within 2 days. About a week later, however, the same symptoms recurred and then culminated in vomiting not explained by any indiscretion in diet.

Upon initial examination the following day the child was found to belong to the thin, rapidly-growing, rather neurotic type, somewhat apprehensive, and devoid of elasticity in her movements, particularly her gait which had first seemed unnatural following her few days' illness. She walked a trifle stooping as if she might be favoring a sore appendix or bladder, but her steps were more like those of one treading a series of rough railroad ties under the compulsion of keeping a rail always between the feet. There was a suggestion of increased tension on the right side of the abdomen but no definite tenderness or rigidity. Both knee jerks were active and there was no apparent weakness in foot or leg action. In other respects the physical examination was negative. The urine, however, showed a very faint trace of albumin, an occasional hyaline and one finely-granular cast and about 40 leucocytes per field.\*

Eight days later, January 12, following regular dosage with an alkaline diuretic mixture, the urine was normal. During this interval there had been no recurrence of the nausea or abdominal pain but the child still walked unnaturally. Accordingly a more careful examination was made looking toward the existence of flat foot or pressure sores from the shoes. Nothing of importance was remarked except that the feet showed good arches when the body weight was not imposed upon them. It developed at once, however, that rising on the toes, walking tiptoe, and standing on one foot were all extremely difficult owing to failure of balance. The knee jerks were somewhat over-active. The plantars were not tested. Only *after* the conclusion of this examination did it seem clear that the case was actually neurological.

During the 10 days preceding the next visit, it was noted independently by an older member of the family that the little girl's feet assumed a peculiar position with the toes involuntarily turned up. On inspection this was confirmed and at the same time a slight exaggerated hollowing of the arch of the resting foot and

\* Low power. Specimen uncentrifuged.



some unnatural convexity of the dorsum were remarked, this condition being bilateral. Both knee jerks were now definitely exaggerated, a bilateral Babinski was elicited and a Romberg test, though somewhat uncertain, seemed strongly suggestive.

The patient was next seen on February 5 and then gave evidence of considerable general improvement, having gained 3 pounds during the preceding month. Her suggestive signs seemed less marked but she still presented practically all those mentioned and in addition possibly a very slight lateral jerking of the eyes when they were held voluntarily in extreme conjugate deviation. No positive nystagmus was detected. Vision, pupillary reactions, speech, and bladder and rectal control have been normal; and there have been no disturbances in cutaneous sensation. Although no spinal fluid Wassermann test was made, a blood Wassermann taken January 22, proved negative. Up to the time of this report there have been no further unfavorable developments and the patient's general health has remained good.

*Summary.*—During a period of 7 weeks there was noted in the case of a girl of 11 years with negative previous history, a brief, mild illness with nausea and abdominal pain, evidence of temporary kidney irritation, slight but definite ataxic gait and instability, increased knee jerks, and a bilateral Babinski sign, with exaggeration of the normal plantar arch and a tendency of the toes to turn upward. These manifestations in conjunction with a negative Wassermann test lead to the belief that the case may be one of Friedreich's Ataxia.

The literature dealing with this subject has been steadily augmented during the 3 score years since Friedreich described the condition until at present even general works on medicine and pediatrics contain many paragraphs referring to the condition. A brief résumé of the features usually emphasized is appended.

*Definition.*—A slowly progressive disease of the spinal cord occurring in late childhood, characterized clinically by loss of equilibratory control, ataxia affecting progression, nystagmus, and peculiar deformities, particularly a form of talipes equinovarus or pes cavus. The disease is dependent anatomically upon primary degeneration of the dorsal columns and spino-cerebellar and pyramidal tracts.

The types ordinarily described are 3: Friedreich's spinal ataxia,

spino-cerebellar ataxia, and cerebellar ataxia. (Hereditary spastic paraplegia is mentioned by Dana (text-book of nervous diseases) as belonging to the same group.)

*History.*—Following Friedreich's description, Brousse, a Frenchman, gave the name of the former to the disease, and later Marie differentiated the cerebellar form, typically combining onset after the twentieth year, increased knee jerks, ocular paralyses and optic atrophy. Schultze, in 1877, showed that the form described by Friedreich was unrelated to locomotor ataxia and was due to inherent defective cord development.

Typical hereditary spinal ataxia of the type first described is comparatively rare. Schoenborn (Burr, Text Book on Nervous Diseases), in 1901, could collect only about 200 positive cases and later made the estimate of another possible 200 cases in the next 15 years. Griffith (Transactions, College of Physicians, Phila., 1888, X, 196, and Diseases of Infants and Children), reported 143 cases in 1889, but believes that some of these cases might properly fall into a different category. He cites the record of the family reported by Carre (*De l'ataxie locomotrice progressive*, 1865, 65; 248), in which the grandmother, 9 of her children, and 7 children of one affected daughter were all victims of the disease.

*Etiology.*—Fundamentally there is in the spinal cord a lack of development, which is inherited indirectly, oftener than immediately, from either parent. The degeneration which occurs is superimposed upon the primary abiotrophic defect. Schoenborn found the disease to be familial in 114 of 200 cases. Approximately 60 per cent. of cases observed have occurred in males. The incidence is most commonly between the ages of 5 and 15 but cases have been reported between the ages of 2 and 4, and occasionally after maturity. Consanguinity, alcoholism, syphilis, and insanity have been noted in ancestors of the patients, but neuropathic ancestry is by no means always a discoverable factor. The first symptoms of ataxia often follow an acute illness or one of the infectious fevers.

*Pathology.*—A striking feature remarked by many observers is the small caliber of the spinal cord. There is sclerosis of the dorsal columns of Goll and Burdach, typically also of the crossed pyramidal and spino-cerebellar tracts, and usually involvement of

the columns of Clarke and Gower. In cases of the Marie type, there is likewise atrophy of the cerebellum, while even in Friedreich's ataxia atrophic changes in the cerebellum have been reported. In most instances, however, the cerebellar changes have been limited to hypoplasia. Secondary changes in the dorsal roots are common. The variability of the symptoms noted has been easily explained by the fact that even in extreme sclerosis normal fibers persist and degenerations in different portions of the cord may or may not be simultaneous. The cerebrum is apparently unaffected.

*Symptoms.*—The first awkwardness in gait frequently makes its appearance after an acute illness or a period of physical depression. Gradually the steps become unsteady, the feet are placed wide apart and there is an increasing tendency to stumble. Checking a quick run and wheeling about in the reverse direction calls for excessive movements of the arms to maintain balance or gain direct support from some stationary object at hand. In standing the trunk is held forward, the legs and arms and even the hands are held slightly flexed, and there may be oscillatory movements of the head and trunk. As the disease advances the gait becomes more staggering, but does not include the throwing out movements of the feet characteristic of true tabes. The knee jerks may be present early in the disease and are occasionally exaggerated as in the case presented, but usually become lost within a year. There is contracture of the posterior tibial muscles and hyperextension of the large toes resulting in talipes equinovarus, one of the most reliable signs of the development of the condition. In cerebellar ataxia also this sign may exist. In the later stages, ataxia of the upper limbs, paraplegia, claw hand, scoliosis and kyphoscoliosis supervene; and nystagmus and scanning speech are added. There is usually a positive Babinski sign. Romberg's symptom is variable. Characteristically control of bladder and rectum are unimpaired.

The course is extremely slow and attended by periods when no added symptoms are noted and good general health may veil the gradual retrogression in the nervous system, thus giving the impression of improvement. Five to 10 years may elapse before the patient is bedridden and as many more before death ensues from pneumonia or some other intercurrent disease. From a re-

view of the descriptions it is difficult to foretell with any accuracy the sequence of the symptoms in a given case.

The pathogenesis of the individual symptoms calls for considerable explanation which is not adequate even in some of the best neurological text-books. "The ataxia in its spinal components is to be traced back to the process in the posterior columns; in its cerebral components, to the degeneration in the lateral cerebellar tracts" (Burr, Text-Book on Nervous Diseases). When the cerebellum is not properly informed as to the status of muscles dealing with coördinated action, owing to improper or defective transmission of impulses through the degenerated spino-cerebellar tracts, ataxia is the result. The lack of marked impairment of sensation is explained by the facts that pain, temperature and pressure are not dependent on the posterior columns for their transmission whereas sensations giving an idea of position and degree of contraction of muscles are thus conveyed, the result thus being ataxia without paralysis. The Babinski reflex is explained by involvement of the pyramidal tracts; and the loss of deep reflexes, by degeneration of the lower sensory neurons. The nystagmus, likened to intention ataxia, and the dysarthria have been ascribed to degeneration in the brain stem.

*Prognosis.*—The outlook in a given case for many years of life is good. The outlook for health permitting efficiency is of course practically hopeless.

*Diagnosis.*—This is possible even without a family history if one reviews the following tabulation in connection with thorough observation of the suspected case.

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*Friedreich's Ataxia.*

Heredity.  
Onset 5 to 15 years.  
Ataxia, lower limbs first.  
Loss of knee jerks within one year.  
Babinski.  
Nystagmus.  
Pes cavus, claw hand, scoliosis.

*Hereditary Cerebellar Ataxia*

Onset, later.  
Ataxia of all limbs.  
Reflexes increased.  
Optic atrophy.  
*Rarely* deformity of foot or spine.

*Multiple Sclerosis.*

Early adult life.

<i>Juvenile Tabes Dorsalis.</i>	Ataxia spastic.
Early adult life.	Intention tremor.
Lightning pains and girdle sensations.	Increased reflexes.
Early loss or diminution of reflexes.	Nystagmus, scanning speech.
Ptosis.	Optic atrophy. Pallor of optic discs.
Pupillary signs.	
Bladder and rectal symptoms.	<i>Multiple Neuritis.</i>
Stigmata of syphilis.	History. Ataxia. Sensory and
Positive Wassermann.	Motor Symptoms.

*Treatment.*—Aside from measures to maintain good general health there is no treatment. Education in muscular movements to compensate for the ataxia, as in the treatment of tabes by the Fraenkel method, may be of some avail.

GAYLORD W. GRAVES.

CASE No. 17.\* Male, 13 years old.

Alvin S. was referred to the cardiac class of the Post-Graduate Hospital Pediatric Department, because of a heart condition resulting from repeated rheumatic attacks. He was first seen November 20, 1920, and has been under observation to the present time.

The family history is practically negative, except for the facts that the paternal grandmother died of a malignant growth, and an older sister, 3 years the patient's senior, is the victim of a congenital "muscular paralysis." The mother has 6 times been pregnant, the second and sixth pregnancies having resulted in induced abortions. The patient is the second child, and was born at term after a 4 hour instrumental delivery. The birth weight was 11 pounds. He sat up alone at 9 months, said words that could be distinguished as such, and walked at 12 months. He was a breast fed baby for 12 months, and there was nothing unusual observed in the introduction of the usual articles of food into the child's dietary. He had chicken pox at 3

\* A case of lipodystrophy. Case presented before the Section on Pediatrics, New York Academy of Medicine.

years of age, and measles at 4 years of age,—these being the only usually accepted children's diseases which he has had. He has not been subject to colds, nor has he had sore throat, although the school physician found large tonsils and advised their removal, an operative procedure which was carried out at 7 years of age. There were no complications, following this operation, although it is remembered that the operating surgeon made a special point of examining the ears, following the operation.

During the winter of 1919-1920, the patient had a rheumatic involvement of the extremities, in which the elbows and the knees were the most markedly affected joints. There is a definite history of relatively high fever, pains, and swelling of these articulations, for which he was under the care of a physician for about 6 months. The second rheumatic manifestation started in September, 1920, and was much more severe than the first, resulting in his being in a hospital for 8 weeks. It was during the course of this second attack that it was discovered that there was a cardiac involvement which later brought him to the cardiac class.

The mother states that Alvin's facial contour was round, and his color rosy, until after his operation for the tonsils. The early pictures, showing him at 5 months and again at 3 years, bear out this statement, and it is unfortunate that there are not available other pictures showing him in the interval between 3 years and 9½ years. In connection with mention of the tonsil operation, the only other male patient whom I have seen with this condition, a boy of about 10 years, also, was first noticed to be "wasting" after an operation for the relief of a persistent nasal discharge.

No great attention was paid to the facial condition until about 2 years ago, when Alvin was approximately 8½ years old. At that time it was noticed that his rounded facial contour was steadily changing, progressing steadily until the present appearance was attained. This was not a sudden change, nor was it coincident with a similar change of contour of other portions of the body. The matter was given little attention, however, as it was thought that he might "outgrow" the changed appearance. When the condition became more prominent, and there was no sugges-

tion of its clearing up, the household explanation that it had resulted from the operation for removal of the tonsils, was brought to the fore.

The physical examination reveals unusual findings in 2 fields. There is a typical mitral, endocardial involvement, and, secondly, an abnormal absence of fatty tissues about the face and neck. This unusual distribution of the fatty tissue has remained unchanged since its development. The weight on first observation was  $68\frac{1}{2}$  pounds, which, in the 5 months, has increased to 74 pounds,—the increase not having had an appreciable effect upon the tissues above the shoulders. We have not been able to demonstrate pathology present on examination of the blood, stool, and urine. The patient is active, happy, interested in school, and is proverbially mischievous.

In connection with the condition which is present, the following are some of the more important points:

1. An unknown etiological factor or group of factors causing unusual fat distribution involving the upper portion of the body, usually most marked in the face and neck, but at times affecting the upper extremities and trunk. The characteristic change produced is an absence of the subcutaneous fat from the areas, without the presence of changes in the muscular and nervous tissues.

2. Most of the cases occur among females, giving rise to the earlier idea that lipodystrophy did not occur among males. Of the 30 odd reported cases, there are at least 3 undoubted cases among males.

3. The condition is progressive in that the fatty tissues in the areas involved become eventually completely absorbed. The rule is that the progress is slow.

4. There is practically no response of the fat containing tissues of the affected areas to the effort to distribute fat and build up subcutaneous tissue.

5. References to the increasing literature on the subject throw no light on the etiology or treatment, other than to suggest measures for general upbuilding in the expectation of increasing subcutaneous connective tissue, or possibly, to fill out the affected areas with a bland material, as paraffin.

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GEORGE R. IRVING.

SUGAR IN INFANT FEEDING (Bulletin de l'Académie de Medecine, Paris, Feb. 22, 1921). Nobécourt recalls that infants get about 8 to 12 gm. of lactose per kilogram daily in breast milk, and he thinks that more use should be made of sugar in infant feeding. Saccharose in large doses is useful to give more nourishment when the food has to be restricted in fats and proteins, and also when forced feeding is needed. He adds 10 or 15 gm. of sugar to 100 gm. of the food being used, or if the child is breast fed, gives a few teaspoonfuls of highly sweetened boiled water. Habitual vomiting is often arrested by this highly sweetened food. The weight is often brought up to normal when the food is highly sweetened, and the sugar is borne without inconvenience in acute and subacute gastro-intestinal disease, with or without fever. It tides the child along to a more nourishing diet, and seems to promote the disappearance of the diarrhea. He has always found the sugar borne without disturbances in all pathologic conditions; a counter test is found in the evil effects that follow deprivation of sugar, as in feeding with albumin milk.—*Journal A. M. A.*





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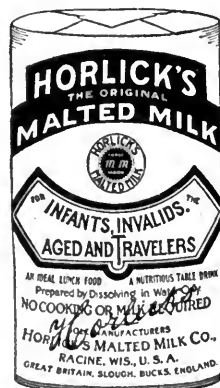
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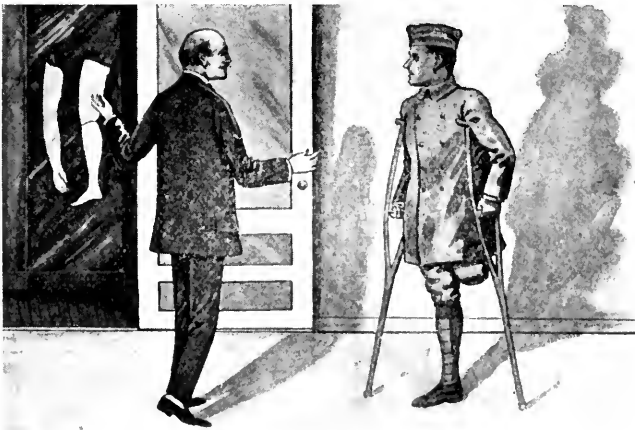
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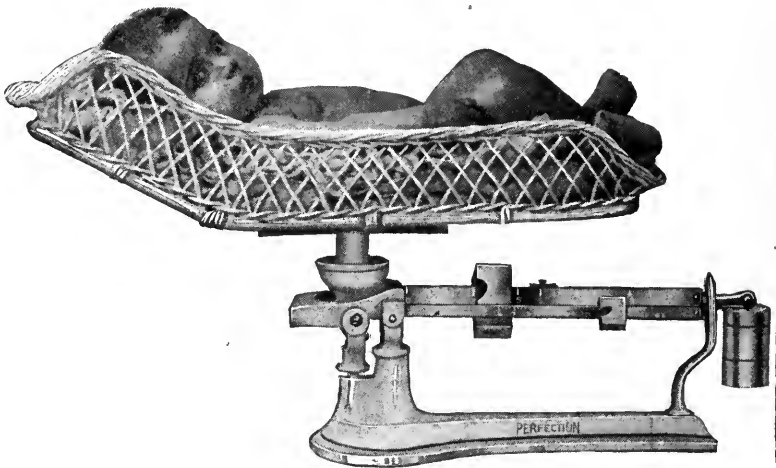
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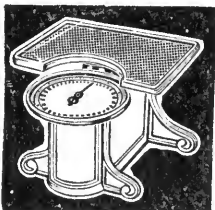
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## ORIGINAL COMMUNICATIONS

ACUTE ABDOMINAL CONDITIONS IN CHILDREN.

AN ANALYSIS OF TWO HUNDRED CASES.\*

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Washington, D. C.

It is a generally recognized fact that the clinical pictures of acute abdominal conditions in children differ greatly from those in adults. In our analysis we shall endeavor to illustrate certain points that bear out this distinction, and to emphasize the difficulties encountered in the matter of differential diagnosis.

Corner<sup>1</sup> states that acute abdominal conditions are relatively and absolutely less frequent in children than in adults, and that appendicitis is relatively more common in adults than in children. In our series appendicitis, with and without complications, con-

\*From the case records of the Children's Hospital, Washington, D. C.

stituted over 60 per cent. of the cases. Hartshorn<sup>2</sup> lays stress on the fact that appendicitis in children is an insidious disease and associated with a variety of clinical pictures, so that unfortunate mistakes are sometimes made. Kerr<sup>3</sup> emphasizes the importance of pneumonia as a cause of acute abdominal symptoms in children, a point well illustrated in several of our cases. Hutchison<sup>4</sup> states that the causes of acute abdominal pain in children are far fewer than in the adult, and mentions acute indigestion, appendicitis, and some form of intestinal obstruction as the chief considerations.

A review of the literature on this subject seems to show that the experiences of surgeons and clinicians emphasize the varied clinical manifestations of acute abdominal conditions in children, and the problems met with in arriving at a satisfactory diagnosis.

In presenting this series of cases we shall, besides giving a brief statistical record, attempt to feature the points illustrating the problems of diagnosis.

One hundred and twenty-four cases of appendicitis in all stages were studied and analyzed. Of these, 59 (47 per cent.) showed ruptured appendices with peritonitis; 31 (25 per cent.) were of the acute catarrhal variety; 15 (12 per cent.) cases showed appendiceal abscess, 9 of which were walled off; 11 (9 per cent.) cases were of the acute suppurative type; 8 (6 per cent.) cases were of the chronic type. Regarding race, 74 (59 per cent.) occurred in white, and 50 (41 per cent.), in colored children. Regarding sex, 76 (62 per cent.) were in males and 48 (38 per cent.) in females. Relative to age incidence, our youngest patient was 2 weeks old and the oldest 12 years, with an average of 8 years.

Age in years .....	1	2	3	4	5	6	7	8	9	10	11	12
Number of cases.....	0	0	8	6	8	10	14	18	16	18	16	10

The onset was sudden in 102 cases and gradual in 22. The symptoms present some interesting features. Constipation was present in all but 12 cases. In practically every case abdominal pain was the first symptom, being generalized in 90 per cent. Nausea and vomiting occurred in all but 6 cases, while headache was present in only 26 cases. In 8, there was a history of chills, with diarrhea in 4. The degree of pyrexia occupied the background with regard to its diagnostic value. The highest tem-

perature on admission was 102°, the average ranging from 100° to 101°. Relative to the duration of illness before admission to the hospital, the shortest period was 24 hours, and the longest 21 days. (This case was of the chronic type.) Most of the patients came into the hospital within the first 3 days of illness.

A word here concerning the clinical picture presented by the patients on admission—13 showed marked prostration; 77 were acutely ill; 19 were moderately ill, and 12 appeared fairly comfortable. Three little patients presented, in addition to the usual abdominal symptoms and signs, some degree of drowsiness.

The variations in physical findings are of interest. Abdominal tenderness was present in 96 cases and rigidity in 88. Various degrees of abdominal distention occurred in 22 cases. It is interesting to note that only 16 cases presented the triad: rigidity, localized tenderness and distention, and that but 32 showed localized tenderness and rigidity. The classical physical findings were present together in but a small percentage of cases. This point we wish to emphasize particularly, as it has a significant bearing on the question of differential diagnosis. Localization of pain and tenderness over McBurney's point within 24 hours of onset occurred in 54 cases. One case of appendiceal abscess presented several atypical symptoms and signs. The pain was referred from the lumbar region and localized in the umbilical area. There was also some degree of urinary retention. Another case, in which the appendix was retrocecal, presented extreme tenderness over the dorsolumbar spinal area, with pain in the right hip and thigh.

*Blood Counts* were obtained in nearly all cases, the highest leucocyte count reaching 30,000. The lowest count was 11,800, with 16,000 as an average.

*Urinalysis*, in the majority of instances, presented nothing remarkable other than moderate degrees of albuminuria. Six cases showed a 3 plus acetone, and in 3, the urine contained pus. These cases, however, were of the extreme type, with rupture and peritonitis.

Concerning surgical procedures, 105 cases were operated upon within 48 hours of admission. In 19 cases, there was no surgical intervention. Of these, the parents refused operation in 6, one case was treated medically, with recovery from the

attack, while in 12 cases, in extremis, operation was deemed inadvisable at the time.

Relative to operative findings, in 59 cases the appendix had ruptured, with a generalized peritonitis following. The acute catarrhal variety was encountered in only 31 cases, while in 11 the appendix was of the suppurative type. There were 15 cases in which appendiceal abscess was present, and of these, 9 were walled off. The chronic type was found in 8 cases.

As regards *complications*, peritonitis stands out most prominently. Besides the 59 cases mentioned, 4 developed post-operative. Bronchopneumonia occurred in 3 cases and renal complications in 9, one of which was a well-marked pyelitis.

The mortality in this series was 25 per cent., the vast majority of deaths occurring in the complicated cases.

The chief purpose of our analysis of these cases is to emphasize the variations in symptoms and signs which one so frequently encounters in these acute abdominal conditions, and to lay particular stress on the fallacy of looking for a typical clinical picture in every instance. It should be borne in mind that a child's reaction to disease is a distinct clinical entity as compared with the syndrome predominating in an adult suffering from that same disease. The following cases will serve to illustrate many of the points in question:

A. S., a white, male child of 11 years, admitted with complaint of abdominal pain localized over the right iliac region, vomiting, constipation and fever. Family and past history negative. Present illness began 4 days prior to admission, with generalized abdominal pain of a "crampy" character, and a slight elevation of temperature. Prostration was quite marked, but the child did not go to bed until the second day, when the symptoms increased in severity. At this time vomiting occurred, which persisted. Constipation was marked until one day previous to admission, when diarrhea developed.

*Physical Examination.* Child is acutely ill. Anxious expression, tongue coated, and lips dry. The child lies with thighs flexed on abdomen. There is no abdominal distention, but tenderness and rigidity are well-marked, and localized over McBurney's point. Heart and lungs are negative. Temperature 100.8°, pulse 120, respirations 30.

*Diagnosis.* Acute appendicitis. At operation the appendix was found ulcerated and perforated, with a localized peritonitis.

*Comment.* Here we have a rather clearly-defined clinical picture of an acute appendicitis. The history of a sudden onset with acute abdominal pain, generalized at first and later localizing in the lower right quadrant, followed by vomiting, and with fever and constipation, leaves little doubt as to the condition maintaining. The physical signs lend confirmatory evidence, and the diagnosis is hardly questionable. Contrasted with this is the following case:

W. J., a colored, male child of 7 years, admitted with complaint of inability to void, and of abdominal pain and vomiting. Family history negative.

*Past History.* Mother states that the child has often been troubled with enuresis. About a month before admission, the child received a blow over the abdomen, but little attention was paid to it. Of late the appetite has been poor, there has been a great loss in weight and a great deal of "bladder trouble."

*Present Illness.* One week prior to admission the child returned from school complaining of abdominal pain. Later began to cough, and vomited on several occasions. He later complained of pain in the region of the bladder, intensified on micturition. Mother noted at this time that he voided frequently, but only very small quantities. Bowels have been constipated, salts having little effect.

*Physical Examination.* Child appears moderately ill and lies with legs and thighs flexed. Respiration is regular and there is no cyanosis. The tongue is badly coated. Throat is negative. Heart and lungs are negative. The abdomen is slightly distended, with a prominence of the lower quadrant, and with tenderness and rigidity on deep palpation. A mass is palpable, extending from the umbilicus to the symphysis pubis, about  $1\frac{1}{2}$  inches to each side. Rectal examination reveals nothing definite. Temperature  $101^{\circ}$ . Leucocytes numbered 16,000, with 93 per cent. polynuclears. Urinalysis showed a 2 plus acetone, one plus albumen, numerous pus cells, with occasional red blood cells and hyaline casts. Laparotomy revealed a ruptured appendiceal abscess with a general peritonitis.

*Comment.* The history and physical findings in this case

differ markedly from those in the case previously cited. Here we have a conflicting history pointing to some condition involving the urinary tract, probably centered in the bladder. The physical findings in this case would also tend to focus one's attention in this direction. Abdominal pain and vomiting are the only symptoms which point to a diseased appendix. So it is obvious that in this case a direct diagnosis could not be absolutely made as in the previous one.

Eleven cases of intussusception were studied. The youngest patient was 8 months, the oldest 9 years; 8 cases occurred in males and 3 in females. The onset was sudden in practically every case. Abbott<sup>5</sup> states that sudden, violent abdominal pain accompanied by vomiting, in a child otherwise well, initiates the attack in 100 per cent. of cases. Our cases presented this type of onset, and in nearly every one the clinical picture was characteristic; the classical syndrome presenting included sudden abdominal pain, vomiting, prostration, the passage of stools containing blood and mucus with scant fecal material, slight or no elevation of temperature ( $102^{\circ}$  in one case), rapid, feeble pulse, restlessness and a palpable tumor mass. At operation, the point of intussusception was seen, in almost every instance, to be at the ileocecal junction. Regarding the differential diagnosis, in the majority of cases the clinical manifestations rather definitely conform to the picture of intussusception. However, in certain cases in which the symptoms and signs are atypical, the diagnosis is often difficult. Appendicitis and ileocolitis are 2 conditions to be considered. Griffith<sup>6</sup> states that Henoch's purpura, with hemorrhage into the lumen and the walls of the intestine, may strongly suggest intussusception. It has been our experience that ulcerative ileocolitis not infrequently presents many features simulating intussusception, so that the diagnosis is often questionable.

Recently a condition of chronic intussusception has been described by Still<sup>7</sup>, defining the term "chronic" as meaning cases in which the intussusception has been present for days or even weeks without producing any acute obstruction. In this connection he emphasizes the fact that the condition may be overlooked because of the general idea of associating it with the clinical picture of an acute intestinal obstruction. The symp-

toms described are colicky abdominal pain, irregular periods of vomiting, and wasting.

Twelve cases of tuberculous peritonitis with acute abdominal symptoms are included in this analysis. Of these, 8 occurred in females and 4 in males. Regarding color, only 2 were in white children. The average duration of illness before admission was one week. Relative to the symptomatology, generalized abdominal pain was present in all the cases. Five were acutely ill, the others only moderately. Constipation was noted in 6, and diarrhea in 4 cases, while in 2 the bowels were fairly regular. The highest temperature was 102°, the lowest 100°. Vomiting occurred in 5 cases. The average leucocyte count was 9000. The von Pirquet test was positive in 10 cases. General adenopathy was noted in 10 cases. Concerning the physical findings, abdominal rigidity was present in only 2 cases. Marked abdominal distention occurred in 5 cases, with dullness in the flanks and tympany over the center. In the remaining cases the abdomen was of a soft, doughy consistency. Laparotomy, performed in 4 cases, revealed enlarged mesenteric glands with the peritoneum studded with miliary tubercles.

The foregoing analysis represents the greater proportion of the cases studied, appendicitis standing out as the most common condition met with. The cases constituting the remainder of the series include intestinal obstructions other than intussusception, acute indigestion, ileocolitis, typhoid perforations, one case of renal sarcoma, strangulated hernia, and respiratory infections with acute abdominal symptoms. In discussing these we shall confine ourselves to the points arising in the question of differential diagnosis, citing only those cases which are of illustrative value.

A fairly common problem often confronts one in the differential diagnosis of a lobar pneumonia with pleurisy and an acute appendicitis. Campbell and Kerr<sup>8</sup> emphasize the importance of an examination of the thoracic viscera in cases with acute abdominal symptoms, stating that "an acute abdomen and right iliac pain are often the first signs of a pneumonia or pleurisy." This is well illustrated in one of our cases. A child of 4 years was admitted with complaint of abdominal pain, most marked on the right side, vomiting, fever, and a slight unproductive

cough. Onset was sudden, beginning 3 days before admission. Past and family history negative. Physical examination revealed abdominal distention and tenderness, the latter most marked over the right lower quadrant. The only lung signs elicited were impaired resonance over the lower right lobe posteriorly, with distant breathing and a few scattered râles. There was no dyspnea or cyanosis. Leucocyte count was 13,000. The question arose as to whether an acutely inflamed appendix or a pneumonia was responsible. The following day the symptoms and signs of a well-developed lobar pneumonia predominated, with the abdominal signs disappearing. The main issue in this and similar cases lies in the question of operation. It is at once apparent that a needless operation may follow a mistaken diagnosis.

It not infrequently happens that 2 conditions may exist coincidentally, with the clinical features of one outshadowing the other, so that one condition may be entirely overlooked. Recently we had occasion to have this point emphasized. A child of 2 years was admitted with complaint of diarrhea of a week's duration, with the passage of blood and mucus in the stools. Temperature on admission was 103°. The abdomen was distended and there was generalized tenderness. The stools, upon bacteriologic examination, were found positive for the Y-bacillus of dysentery. Our attention was focused on this one condition as the cause for all the signs and symptoms. At autopsy, in addition to ulcerations of the colon, the peritoneum was found flooded with pus, together with a suppurative appendix. There was no evidence of a perforated ulcer at any point in the lower bowel. It is an interesting speculation in this instance as to what relation these conditions bore to each other.

Acute gastrointestinal disturbances, arising from dietetic errors and other factors inhibiting the digestive functions, play an important rôle in adding to the difficulties regarding the diagnosis of an acute (surgical) abdomen. As an example of this, we cite a case in which 3 children of the same family were admitted with symptoms which, ordinarily, might well have been mistaken for some acute abdominal condition. The history, however, obviated this possibility, since all 3 had eaten some contaminated food and had been taken sick at the same time.



It will not be amiss here to discuss briefly the behavior of a typhoid intestinal perforation in a child. Four cases are included in this series. Although this is a rare complication in children it is important to be familiar with the clinical picture, since it does not always present itself in the typical phases seen in the adult. Three cases presented a fairly characteristic syndrome, so that the diagnosis was not difficult. In one, however, the onset was of a sub-acute type. There was no sudden abdominal pain with a drop in temperature and collapse. The child complained of abdominal pain of moderate severity, with tenderness. There was no marked drop in temperature and the child did not go into collapse. Later the temperature rose, prostration was quite marked, and there was a clearly defined clinical picture.

This last case cited further bears out the first statement in our opening paragraph. We have attempted, in presenting this analysis, to lay stress on the fact that the clinical manifestations of acute abdominal conditions in children are often atypical, and to emphasize certain points illustrative of the problems in diagnosis which confront the pediatricist and the surgeon alike.

#### SUMMARY.

1. Appendicitis is one of the most common of the acute abdominal conditions in childhood.

2. Acute gastrointestinal disturbances are apt to simulate the "surgical abdomen," and one should be on the alert to differentiate.

3. The symptoms and signs of the acute abdomen in the child do not always conform to the diagnosis of any one condition.

4. Mistakes in diagnosis are often made because one is too apt to look for characteristic clinical features and to be misled by atypical syndromes.

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# COLIC IN BREAST FED INFANTS AS A RESULT OF SENSITIZATION TO FOODS IN THE MOTHER'S DIETARY.\*

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There is nothing in the field of pediatrics that is more annoying to the physician and more aggravating to parents than persistent colic in infants. Often this symptom is due to an obvious error in feeding. Especially is this so in artificially fed infants and can be corrected by simple regulation of the diet according to well defined principles. Not infrequently, however, it occurs in the absence of detectable error and the physician and parents alike are totally at a loss as to how to proceed. This particularly is true of nursing infants. Frequently has it been considered necessary, in past days, to wean the baby and many an infant has thus been deprived of the protection of maternal nursing. It is the purpose of this paper to discuss this latter type of condition in breast fed infants.

Until recently it has been generally held that it was immaterial to the infant what the mother might eat so long as she ate a good all round diet and did not partake of foods that did not agree with her. Of late, however, it has been shown that this is not true.<sup>1</sup> Foods that the mother eats may appear in the breast milk and may give rise to allergic reactions in the nursing infant. Such reactions may be in the form of skin, respiratory or gastrointestinal manifestations<sup>2</sup>. The following cases are illustrative of the latter form of allergic symptoms resulting from one or more foods that the mother was eating.

CASE 1. Baby boy, breast fed, 6½ weeks old. Seen because of crying, especially at night, frequent curdy stools and gaseous distention of the abdomen. Regulation of feeding to a proper amount, figuring 100 calories to the kilogram per 24 hours, given in 5 feedings a day, did not improve the condition. Inquiry into the diet of the mother revealed that she was eating one egg for breakfast every morning. By anaphylactic experiment, egg protein was demonstrated in the breast milk. Removal of egg from the mother's diet resulted in a cure of the colic and a return

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of the stools to normal, except for a small amount of fine curd, within a week's time

CASE 2. Baby girl, breast fed, 6 weeks old. Seen because of crying, regurgitating, frequent green slimy stools and gaseous distention of the abdomen. The infant had been fed too often and regulation of nursing to a 4 hour schedule, 5 feedings daily, resulted in considerable improvement in 3 weeks' time. However, the stools are still slimy and green and there was still considerable crying. Removal of eggs from the mother's diet, simply because she ate a large number daily, resulted in a prompt recovery from crying and slimy stools, as well as from a seborrheic eczema, which had been present on the scalp, and milk crusts, which had been present on the cheeks.

CASE 3. Baby girl, breast fed entirely, except for oatmeal gruel, in small quantities, 7½ months old. Had had a great deal of colic for the first month and a half. This was accompanied by frequent curdy stools and considerable gas. There had been also transitory skin eruptions during this time. From that time, until a few days before coming to the office, the patient had been free from colic or skin manifestations, although the stools had always contained some curd. For 3 days before coming to the office, the infant had been in constant pain, with considerable gaseous distention. The stools had been only once daily and had contained very large curds. There were no skin manifestations. The infant was tested with the foods the mother was eating, as well as with oats of which the patient had had a small quantity. A definite erythematous reaction was obtained to beef, of which the mother ate a great deal, and lesser reactions were shown to peas, egg-white and veal. These foods were stricken from the diet of the mother and no other change was made. In 3 days all colic had disappeared and in a week's time even the stools, which had always contained some curd, were perfectly normal.

CASE 4. Baby girl, 3 weeks old, and breast fed, had been getting too much food and was having a great deal of colic, curdy stools and gaseous distention of the abdomen. Regulation of diet to the proper amount, plus the administration of bacillus bulgaricus, produced no change in one week's time. Empirically the mother was told to eat no eggs and to continue the adminis-

tration of bacillus bulgaricus. Two weeks later, the infant's condition was some better, but colic still persisted and stools were curdy. The mother said she had not been eating eggs but had been eating a good deal of food containing eggs. The infant was then tested with the foods that the mother was eating and erythematous reactions were obtained to egg-white and to veal. A lighter reaction was obtained to beef. The mother was instructed to eat no egg or food containing egg, and no veal. This she did and there was prompt disappearance of the colic. The mother did not return because she considered the baby cured but she told me 3 weeks later by telephone that the baby had been, for some time past, and still was, entirely normal, except that there were still at times some small curds in the stools.

CASE 5. Baby girl, 4½ months old. The outstanding feature of the history was that the mother had been obliged to wean the baby because the breast milk had not agreed. While on the breast the infant had vomited constantly and had had frequent green and curdy stools. At 2 months, the mother had begun to wean the baby and had taken her entirely off the breast one week before coming to my office. The baby was atrophic, extremely weak and was doing very poorly on the milk mixture she was getting. There being still considerable milk in the mother's breasts, the infant was tested with the foods that the mother habitually ate. A very definite reaction was obtained to egg consisting of both an erythema and wheal, and a lesser reaction was obtained to cow's milk casein. The mother was instructed to eat no eggs or food containing eggs and the baby was placed back at the breast. Improvement was immediate. The infant took the breast milk without vomiting or showing other signs of disturbance. It was necessary to give a cow's milk complementary feeding. This the mother was instructed to boil thoroughly and the infant seemed to take it without gastrointestinal manifestations. As the breast milk increased it was possible to cut this down gradually to 2 ounces of a half milk mixture at each feeding. The infant has continued to thrive.

CASE 6. Baby girl, 3 weeks old, breast fed entirely. Had had colic constantly since coming home from the hospital one week previously. Correction of the over-feeding and administration of bacillus bulgaricus together with atropin, had failed to correct

the condition in one week's time. The infant was tested with the foods the mother was eating. Erythematous reactions were obtained to human milk, cocoa, cow's milk, potato, wheat, navy bean, lamb, egg and celery. The mother was instructed to eat no chocolate or cocoa, beans, lamb, egg or celery, to eat no more wheat than she would get in rye bread, to eat potato only 3 times weekly and to drink no more than one pint of milk daily. Improvement was noted in 2 days and after 3 days all signs of colic disappeared. For the past month there have been occasional short periods of crying, probably due to colic but very much less marked than formerly. These attacks may be the result of the protein of the mother's milk.

DISCUSSION. The idea of colic and abdominal pain being caused as a result of the ingestion of foods to which the individual is sensitized is, of course, not new, although a considerable impetus has been added to this phase of the subject by the recent work of Duke.<sup>3</sup> However, that this phenomenon might be causative in the colic and gastrointestinal manifestations of breast fed infants, has some way or other escaped the attention of the medical profession. Our grandmothers will tell us that they have known it all along but to the scientific medical mind the idea has been a vestige of by-gone superstition. It has been generally conceded that foods that the mother might eat did not appear in the breast milk and that therefore they could not result in disturbance in the baby. With the fact recently established that foods that the mother eats, even in moderate quantity, may and do appear in the breast milk, and that they may cause disturbance in the baby, new possibilities present themselves for the permanent cure of a great many of the obstreperous diseases of nursing infants.

Of the cases presented, 4 had been treated according to recognized methods of treatment without result. In all 6 the results obtained by the specific form of therapy mentioned were prompt and in several cases very striking. It is of interest that in every case egg seemed to be one of the offending foods. This corresponds with our knowledge of the rôle played by egg protein in the causation of the manifestations of exudative diathesis in artificially fed infants. Several of the mothers were eating eggs rather infrequently except as they got them in dishes prepared

with egg. One patient had been weaned from the breast because the mother's milk did not agree. Removal from the diet of the mother of the offending food made it possible for the infant to again take the breast milk and thrive.

Czerny denies the statement that breast milk is always the best food for the baby.<sup>4</sup> Case 5 illustrates very well the truth of his contention. However, up to the present time there has been no satisfactory explanation as to why this is so. It has been rather hazily attributed to a disturbance of the fat metabolism of the infant. In this connection it is of interest to note that Case 1 had a fat content of  $6\frac{1}{2}$  per cent. for 24 hours in the breast milk and yet gastrointestinal manifestations disappeared without reduction in the fat content after the offending food was removed from the diet of the mother. In the cases here reported, it seems to have been due to allergic reactions to food proteins contained in the breast milk.

The well known observation that one infant will thrive on breast milk that another cannot tolerate is also explained on the basis of food allergy. Case 1 is of interest from this standpoint also. The mother of this infant had been furnishing breast milk for a premature baby during the time the disturbance recorded was noted in the patient. The premature infant showed no disturbance. We should expect that such would be the case unless the premature baby had also been sensitive to the proteins contained in the breast milk.

#### CONCLUSIONS.

1. Breast milk may transmit foods that the mother eats.
2. These foods may produce disturbance in the infant through the breast milk.
3. Persistent colic in breast fed babies is frequently due to sensitization to foods which the mother eats, and which come to the infant through the breast milk. Removal of these foods from the diet of the mother will frequently result in permanent cure of the colic.
4. Food allergy is a rational basis for explanation of the well known statement that all breast milk is not the best food for every baby.
5. The fact that one infant will thrive on breast milk that

another cannot tolerate is explained on the basis of allergy to foods contained in the breast milk.

6. Recognition and application of these principles will result in the prevention of considerable suffering in the baby and occasionally will remove the necessity for a too early weaning from the breast.

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INTRACRANIAL HEMORRHAGE IN THE NEW-BORN (Pediatria, Naples, Jan. 1, 1921). Vaglio quotes the remark that the mortality is higher on the day of birth than on any other day that humanity has to meet, some estimating that fully 5 per cent. of childbirths end in the death of the child, and that another 1 per cent. die within a few days from obstetric injuries. The low vitality of the prematurely born may be due more to the trauma of the delivery than to the immaturity of the child. Intracranial hemorrhage is the principal harm that results, and this may entail symptoms from the first or not until after a few days. In either event the extravasated blood should be evacuated, and he cites a few clinicians who have done this successfully. He then reports a case from his own practice in which an apparently healthy child of healthy parents the second day after birth developed slight convulsive movements of head and eyeballs which soon spread to include various groups of muscles in trunk and limbs. Extreme collapse followed a hot bath, requiring an injection of camphorated oil and epinephrin internally. Lumbar puncture showed blood in the fluid, with corpuscles and xanthochromia. Improvement followed at once, and the child is now 6 months old, the picture of health. Hot baths and breast milk, fed with a spoon, were the main reliance. The course of the case indicated that the hemorrhage had not been large, the symptoms being due more to the high pressure in the cerebrospinal fluid. The child had presented a slight tendency to jaundice which may have been responsible for the xanthochromia.—*Journal A. M. A.*

## SOME MODERN PRACTICES IN PEDIATRICS.\*

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*Intravenous Treatment.* Intravenous treatment in infancy is indicated far more frequently than in adult life. It is at this early age that we encounter hemorrhagic disease of the newborn, those infants dehydrated through diarrheal diseases and malnutrition, and grave cases of acidosis. Intravenous transfusions of blood and injections of dextrose, soda or both together, and saline have saved many lives since intravenous medication has been found to be practical.

Before 1915, when Helmholtz called attention to the accessibility of the superior longitudinal sinus, intravenous treatment was seldom resorted to, owing to the small superficial veins in a young infant, and hence the difficulty of entering them with a needle, the necessity of dissecting out such a vein, and other difficulties. The whole subject is made so simple by introducing the desired fluids through the anterior fontanel into the sinus that, with experience, the operation can be easily performed by the careful physician.

It is of the utmost importance that the fluids used should be made from freshly distilled water and the solutions of dextrose or normal salt thoroughly sterilized by boiling or sterilized in an autoclave. It should be remembered that solutions of sodium bicarbonate should not be boiled or autoclaved, as the bicarbonate is converted by heat into the carbonate, which is highly irritant. The sinus in question passes upward and backward in the midline of the frontal bone under the anterior fontanel and beneath the sagittal suture lying between the 2 parietal bones, then under the midline of the occipital bone to empty into either the right lateral sinus or torcular Herophili. It is largest just posterior to the posterior angle of the anterior fontanel, and it is here that it is easiest to enter.

Various needles have been devised for this purpose, of which the Goldbloom<sup>1</sup> needle is probably the most satisfactory. It is however not necessary to use any of these for an ordinary No. 21 hypodermic needle will suffice. Not more than 1-60 of body weight of fluid should be introduced at one time.

\*Read before the North Carolina Medical Society at Pinehurst, April 26, 1921.



Aside from sinus injections and transfusions, obtaining specimens of blood for the Wassermann test, blood cultures etc. is greatly facilitated by withdrawing the blood from the sinus by means of an ordinary hypodermic syringe. This can be done within a few seconds time and with much less pain and inconvenience than incising a finger or ear.

It is a practice in some hospitals to give salvarsan by this method. This practice is only mentioned to be condemned, since this drug is so toxic that in case the sinus were transfixed, there would probably be a resultant necrosis of the brain.

*Active Immunization Against Diphtheria.* The highest art in medicine is preventive medicine and in the use of toxin-antitoxin in those who are either susceptible or likely to become so, whereby an active immunity is established, we have an agent for prophylactic treatment equally as valuable as small-pox and typhoid vaccines. In the light of the work of Park, Zinbger and others upon the subject, it seems strange that a fuller understanding of the value, and hence more general application of active immunization against diphtheria is not in use. It is a fact, but nevertheless true, that in spite of the use of diphtheria antitoxin, there is an annual death rate of about 23,500 from this disease in the United States, almost equivalent to the combined deaths from scarlet fever and measles.

Unfortunately neither the disease itself nor antitoxin used so frequently as a prophylactic agent in those who have been exposed to active cases, protect the individual for any great length of time. Through the agency of the Schick test, those individuals who are susceptible to diphtheria can be readily determined. These should be rendered immune by the use of toxin-antitoxin, to be discussed later.

The Schick test is applied in the following manner: The flexor surface of the forearm is selected as the site of preference, the skin is sponged with an antiseptic solution and dried, a measured amount of diphtheria toxin, diluted in normal salt solution (0.2 c.c. of a 1-50 M.L.D. for a 250 gram Guinea pig), is injected intradermally by means of a tuberculin syringe and a fine platinum-iridium needle. The injection should be made into the skin and one should see the eye of the needle through the superficial layer of the skin before pressing the plunger. When

properly executed, a wheal-like elevation is seen with pits corresponding to the hair follicles.

The test is positive, if, at the end of 72 hours, there is a circumscribed area of redness and slight infiltration which measures from  $\frac{1}{2}$  to 1 inch in diameter. This persists for 4 to 5 days, then begins to fade, leaving a light brown pigmented scaling area. A positive reaction thus described, indicating that the individual is susceptible, is due to the fact that there are not sufficient antibodies in the blood serum to neutralize the measured diphtheria toxin introduced into the skin.

A negative reaction, shown by the skin remaining normal at the end of 72 hours at the site of injection, indicates that the individual is not susceptible to diphtheria, as he has sufficient antibodies in his blood serum to protect him. At times a pseudo-reaction occurs, and is to be distinguished from a true reaction in that it appears earlier, is more infiltrated and less circumscribed, and disappears in 36 to 48 hours and does not scale.

In those individuals tested and found to be non-immune, an active immunity can be established by the use of toxin-antitoxin. This can be procured from the New York Department of Health at a nominal cost, or from some of the commercial laboratories. Three injections of 1 c.c. each for children over a year of age, or 0.5 c.c. under a year are made a week apart. The injection is made by means of an ordinary hypodermic needle under the skin of the shoulder or at the angle of the scapula. There is usually a mild local and constitutional reaction, not nearly so marked as is seen when typhoid vaccines are given.

Zingher<sup>2</sup>, in carrying on this work of actively immunizing with toxin-antitoxin for a period of about 4 years, has shown by re-Schicking those who have received 3 doses of toxin-antitoxin, that 95 to 100 per cent. of them still remain immune to diphtheria. Immunity is not immediate but is usually established within 2 months from the time of the last dose of toxin-antitoxin.

Both the Schick test and morbidity records have shown that the age incidence at which children are most susceptible is between 1 and 5 years. After this, natural immunity develops in proportion to the age, so that when adult life is reached between 90 and 95 per cent. of individuals are immune. Most infants have an immunity acquired from the mother up to 6 months of

age. In order to stamp out diphtheria as completely as is small-pox today, we have but to follow these measures: Children between 6 months and 6 years of age should be actively immunized against diphtheria regardless of the Schick test. Children from 6 years up to the age of 15 years should have their susceptibility determined by the Schick test and toxin-antitoxin administered to the non-immunes. This would include all children in the public schools.

*Treatment of Early Intra-cranial Birth Hemorrhage.* Statistics, resulting from post-mortem examinations of infants dying after the first few days of life, show that in about 50 per cent. of cases death was due to cerebral hemorrhage. It is therefore a much more common cause of death than we realize. The bleeding may originate from the dura, pia or arachnoid membranes or from the vessels within the brain tissue. Seitz<sup>3</sup> believes that such hemorrhages originate from: 1. Rupture of the longitudinal sinus or veins emptying into it with blood collecting over the cerebrum; 2. Rupture of the transverse sinus or tearing of the tentorium and release of blood over the cerebellum; 3. Rupture of vessels of the choroid plexus with accumulation of blood in the ventricles. There is history usually of a long difficult labor, precipitate labor, or the use of forceps, or the injudicious use of pituitary extract. It not infrequently occurs in premature infants owing to the fragility of the blood vessels. It may happen where labor has pursued a perfectly normal and uneventful course. It is more frequently the first born child who suffers.

Providentially, a majority of those afflicted die in the early weeks of infancy. Those who survive and have received no treatment grow up to be mental invalids in one way or another, either imbeciles, idiots, spastic paralytics, epileptics or with other less manifest mental abnormalities. Many cases suffering from intracranial birth hemorrhage present absolutely no signs by means of which an early diagnosis may be made, and the condition is only recognized when the baby at the age of 7 to 10 months is found unable to perform the acts which should be accomplished at this time. On the other hand, it is these early cases which offer us the opportunity for completely relieving them.

The symptoms of intracranial hemorrhage are: Convulsions after birth or muscular tremors, cyanosis, stupor, positive Kernig's sign, spastic condition of the extremities, nystagmus or strabismus, bulging fontanel, slow or irregular pulse, irregular or Cheyne-Stokes breathing, pupils contracted or unequal or non-responsive to light. The infant may appear entirely normal for 2 or 3 days and then one or many of the symptoms make their appearance. A tentative diagnosis is strengthened if the mother was a primipara, if labor was difficult, if delivery was instrumental. Should the physician or obstetrician suspect the condition, then lumbar puncture should be done and the blood which originated from the injury, withdrawn from the spinal canal. This should be repeated on several successive days until the cerebrospinal fluid is clear, from 5 to 10 c.c. of bloody fluid being removed each day. A bloody cerebrospinal fluid may mean a contaminated puncture but if the fluid is equally as bloody at the end as at the beginning of the flow, or if the blood is greatly in excess of the amount seen in a contaminated puncture, then we can assume that there was free blood in the spinal canal.

It must not be supposed that all cases of early intracranial hemorrhage surviving, are susceptible of being cured by this method, for if the hemorrhage is above the tentorium the blood cannot be withdrawn by lumbar puncture, but so large a number are subtentorial that we are more than justified in the presence of symptoms, even suggestive of this condition, to perform this simple operation. Rodda<sup>4</sup> has shown that there is a prolongation of coagulation and bleeding times in infants afflicted in this way, and advises in all cases the subcutaneous administration of whole blood. Dr. J. B. Sidbury<sup>5</sup> of Wilmington, N. C., has contributed a marked advance in the treatment of these conditions by determining the pressure of the cerebrospinal fluid by the spinal mercurial manometer and performing daily lumbar punctures and withdrawing bloody fluid until the pressure does not exceed 10 m.m. of mercury. The normal cerebrospinal pressure is 2 to 5 m.m. Dr. Wm. Sharpe<sup>6</sup> of New York, in cases showing a pressure of over 15 m.m. having bulging fontanels and positive ophthalmoscopic findings recommends a subtemporal decompression and drainage.

Of the 6 cases which have come under my observation within

a week after birth, presenting unmistakable evidence of intracranial hemorrhage, and upon whom lumbar puncture treatment was performed, two in a critical condition when first seen died the same night, the result in the case of one is still in doubt, while in the case of the other three there was complete recovery. It may be of interest to very briefly report these 2 cases:

CASE No. 1. Baby H. son of prominent banker of this city, was born after a difficult dry labor. The baby was a full-term infant weighing  $10\frac{1}{2}$  pounds and the presentation was a vertex one. Respiration was established after 5 to 10 minutes, during which time artificial respiration and hot and cold plunges were resorted to. During 3 hours following birth, breathing was intermittent, requiring artificial respiration at intervals. He cried all night and on the following morning there was noticed convulsive twitchings of the right arm and leg. These occurred at the slightest external stimulation, viz: lifting him out of bed, jarring the crib, etc. His head was constantly held in opisthotonos. The physician in attendance gave orders for absolute quiet and for feedings to be given by medicine dropper and 2 grains of sodium bromide every 3 hours. He was seen in consultation on the afternoon of the day following his birth. At physical examination he showed an internal squint of both eyes, weakness of the muscles of the right side of the face, stiff neck, positive Kernig's sign, markedly increased patella reflex on the right side, and toes of the right foot held in flexion. Upon the slightest external stimulus the convulsive twitching would occur and in process of physical examination the baby had a generalized convulsion lasting several minutes.

Lumbar puncture was performed and 3 c.c. of pure blood withdrawn. The blood, clotting within the needle, stopped the flow, so a larger size was inserted and another cubic centimeter of blood withdrawn. The baby slept quietly all night, the spasmodic tremors having practically ceased. He nursed strongly and appeared to be a normal infant on the day following the withdrawal of blood. A lumbar puncture, attempted on the second day, resulted in a dry tap. No further effort was made to enter the spinal canal as the general condition of the baby was excellent and the nervous symptoms had entirely cleared up.

I have seen this baby, who is now 12 months old, a number

of times and he was normal mentally and physically in every way. There is not the slightest doubt in my mind but that this child, had he lived, would have been mentally defective had not this simple operation been performed.

CASE No. 2. Baby B. was seen 2 days after birth, having been referred by the family physician as a probable case of cerebral hemorrhage. Delivery was accomplished by the use of high forceps due to a contracted pelvis in a primipara. The child was born at term and weighed 8 pounds. There was little difficulty in resuscitation. A large cephalhematoma was noticed on the left parietal region and a complete left facial paralysis correctly presumed to be due to trauma from the forceps blade. The baby cried almost incessantly during the night and on the following afternoon had a generalized convulsion lasting for about a minute. Convulsions then occurred at intervals of 10 minutes to half an hour, becoming somewhat modified by the use of sodium bromide given at 3 hour intervals. Physical examination showed a well formed infant having a large cephalhematoma over the left ear and left facial paralysis. The fontanel seemed bulging but this observation was negated by trauma of the scalp. Right patella reflex hyperactive, left not obtained. Pupils negative. Temperature 100°, pulse 140; respiration 60. While undergoing physical examination there was noticed spasmodic twitchings of the right side of the face, the fingers, arm and leg of the right side. Kernig's sign was positive, and neck somewhat rigid.

Lumbar puncture was performed; the first cubic centimeter recovered was almost pure blood clotting in the needle. A larger needle was introduced and 5 c.c. of blood-red fluid was obtained in the second tube, and 6½ c.c. in the third tube, this being less bloody but still highly colored. The baby slept all night and nursed well. Lumbar puncture on the following day resulted in a dry tap. She has had no convulsions since withdrawing blood from the spinal canal a month ago, and seems normal in every way except for the facial paralysis due to trauma, which is gradually clearing up.

*Proteid Sensitization.* For a number of years it has been a recognized fact that individuals may suffer from asthma, urticaria or eczema due to the fact that they are sensitive to certain foreign proteids. The same disease may be caused by different proteids

in different individuals and not infrequently the offending article of diet may be discovered by cutaneous tests.

When this article of diet is removed there results a recovery of the sufferer. While this field of work may still be considered in its experimental stage, the results obtained justify an attempt to remove the cause, especially in those children whom all of us so frequently see suffering from frequent recurrent attacks of asthmatic bronchitis and who hardly get back into fair physical condition before another attack supervenes and this in spite of the most careful hygiene, the removal of tonsils and adenoids, the use of autogenous vaccines, etc.

The technique of the cutaneous tests for proteid sensitization is as follows: The flexor surface of the forearm is cleaned with alcohol and ether and dried, and scratches made about an inch and a half apart. These should penetrate only the outer layer of the skin and there should be no blood visible. The upper scratch is used as a control. A drop of N/10 sodium hydroxid is placed over each scarification and a small amount of proteid from the article of diet to be tested against, placed in the sodium hydroxid and gently stirred with the point of the scarifier until it has dissolved. A positive reaction is denoted by a raised urticarial wheal surrounded by an area of redness of the skin, irregular in outline and from 0.6 to 2 c.m. in diameter, and which becomes manifested within 30 minutes time.

The most frequent proteids to which children are sensitive are those from oatmeal, potato, egg, peas, rice, casein, beef, and chicken. As these articles are among those forming the chief dietary of a child, no one of these should be withdrawn upon the assumption that it is the causative factor, unless the test against it is positive.

*The Treatment of Focal Hemorrhagic Encephalitis by Transfusion.* The writer<sup>7</sup> realizes full well that deductions and conclusions cannot be drawn from one or even few cases, but so striking was the result obtained from transfusing a 14 months old baby who had this disease, that I feel justified in calling the attention of the medical profession to it. The case was reported in detail in the September, 1920, number of the ARCHIVES OF PEDIATRICS. This paper was submitted for publication in April, 1919, at which time it was thought that the baby, while having

recovered physically, would be mentally defective. I have seen the child within the past few weeks and am glad to report that both mentally and physically, she is entirely normal.

Two cases in other towns were transfused by their physicians at my suggestion, with marked improvement resulting. These will be reported in a subsequent paper. One case was transfused by the writer in March, 1921. The transfusion in this case had only a temporary good effect, the child ultimately succumbing to the disease.

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THE AFTER-EFFECTS OF EPIDEMIC ENCEPHALITIS IN CHILDREN (The Lancet, Sept. 3, 1921). Donald Patterson and J. C. Spence have observed the after-effects of epidemic encephalitis in twenty-five children between the ages of three months and eleven years. They believe that we may expect to find various degrees of permanent disability in many of the patients who have had this disease, which may affect either the mental or the physical condition. In this series of cases only one-fourth made a complete recovery. The mortality rate in this disease in children is low; 1 in 25 in the present series. The results of the mental changes following encephalitis in childhood may vary from complete idiocy to slight mental deficiency. They may also show themselves as affections of the character and habits of the child. The physical changes following encephalitis in childhood include spastic diplegia, hemiplegia, symptomatic paralysis agitans, muscular rigidity, and tremors. The younger the child at the onset of the disease, and the longer the acute stage of the illness, the greater will be the degree of mental deficiency which follows it. The severity of the initial attack of encephalitis appears to be in direct proportion to the after-results which follow it. This suggests that could some means of treatment be found which would limit the progress of the disease or shorten its course, the results would not be as drastic as they now are.—*Medical Record*.



## TREATMENT OF PYLORIC STENOSIS.\*

BY H. ERNBERG, M.D., AND B. HAMILTON, M.D.

Stockholm, Sweden.

The improved technique of operative treatment of pyloric stenosis lately has made the results of this treatment remarkably favorable, as demonstrated by various publications in the American medical literature. Downes<sup>1</sup> has published a series of 174 operated cases with 30 deaths (17.1 per cent.), a result much better than those obtained by earlier operators. Still more favorable are the results obtained by Strauss<sup>2</sup>: 163 cases, 107 surgically treated, 3 deaths, all in operated cases. This makes a mortality of 2.8 per cent. in operated cases; 1.8 per cent. in all cases.

Of those writers who have used medical treatment in all cases, the best results, as far as we know, have been obtained by Heubner<sup>3</sup>: of 21 cases, 2 died, (9 per cent.). Lately Reiche<sup>4</sup> has reported a mortality of 10.6 per cent. in 47 medically treated cases. Other reports show a much higher mortality, usually 20 to 50 per cent. or more. A comparison between these results of medical treatment and the favorable results published by Strauss would, it seems, lead to the conclusion that medical treatment would have to be abandoned or at least used only in light cases. The experience gathered at this hospital shows, however, that also by medical treatment very favorable results may be obtained even in very severe cases.

Since 1911, when this hospital was opened, 57 cases of pyloric stenosis have been received for treatment: 46 were boys, (81 per cent.), 11 girls. The birth-weight was between 2500 g. and 4500 g., the average being 3600 g.

All cases had the classical symptoms of pyloric stenosis fully developed: projectile vomiting, emaciation, obstipation and visible peristalsis. The vomiting had, according to the statement of the mothers, started immediately after birth in 2 cases; at the age of 1 week in 6 cases; at the age of 2 weeks in 12 cases; at the age of 3 weeks in 11 cases; at the age of 4 weeks in 20 cases; at the age of 5 weeks in 2 cases; at the age of 6 weeks in 2 cases; at the age of 8 weeks in 1 case. In one case no information could be obtained as to the onset of symptoms.

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\*From the Sachs Baby Hospital; Director: H. Ernberg.

The infants had on admission, in comparison with their birth-weight, lost 1000-1410 g. in 3 cases; 500-1000 g. in 22 cases; 0-500 g. in 21 cases; gained 0-520 g. in 7 cases.

Of the infants, 38 were nursed at the breast when vomiting began.

Of the cases received for treatment, only 2 died, which makes a mortality of 3.5 per cent. One of the fatal cases was complicated by a severe form of palatoschisis, the other suffered from an acute infection when admitted to the hospital.

As our report includes as many as 57 cases, many of whom were severe, we think the conclusion is justified that the favorable course of the disease in our cases must be attributed to the treatment employed. Since the opening of the hospital, the principles followed in the treatment of pyloric stenosis have remained unaltered. These principles are:\*

1. The organism must be supplied with water in sufficient amount.
2. The infants must be nourished with breast milk and
3. Isolated.

Water must be supplied to prevent too high a degree of desiccation. We believe this probably to be the most important part of the treatment. In light cases, Ringer solution is given per rectum in amount of 100-150 c.c. twice daily. It is of course necessary to make sure that the solution really is retained. After some days of this treatment the irritability of the intestines is often increased and the solution is retained in insufficient amount or not at all. Generally, therefore, the solution is given subcutaneously. In cases, where on admission, there is a marked desiccation present or in cases, where there is a rapid weight-loss in spite of the per rectum administration of fluid, subcutaneous infusions are given in amount of 100-150 c.c., sometimes twice daily. As long as there is any tendency to further loss in weight this treatment is continued. In a great number of cases, daily infusions have been given for several weeks. We have cases on record where a total of 100 infusions were given. We have never seen any untoward effects of this treatment and with due precaution accidents may probably always be avoided.

\*An account of this treatment has previously been given by Lichtenstein: *Hygiea*, 1919, p. 627 (Swedish). This article includes a report of the cases treated previous to the date of publication.

It is a well known fact that in pyloric stenosis there is a tendency to spontaneous recovery. The most dangerous result of the stenosis is probably the desiccation of the organism. Consequently this effect of the stenosis must be counteracted as far as possible in order to save the life of the infant until spontaneous recovery begins. The soundness of this reasoning is generally admitted, but it seems, at least to judge from the publications on this subject, that the treatment indicated by this reasoning generally is not carried through as consistently as has been the case at this hospital. A priori, it might hardly be expected that this treatment would have any influence on the duration of the disease. A study of our clinical records shows, however, that in those cases, which were received for treatment early in the disease, the total duration was 1 or 2 weeks shorter than in cases received several weeks after the onset of symptoms. The general condition of the infants is often markedly improved by the treatment; perhaps this improvement may influence the condition of the pylorus.

A factor of the greatest importance is of course the food given to the infants. The infants are here nourished mainly with breast milk, often, however, 1 or 2 meals of buttermilk are given in addition. This combination, of great service in the reparation of severe nutritional disturbances, probably makes the gain in weight more rapid during recovery. In respect to the number of meals, we believe that no fixed rule may be given. Usually we give about 6 meals daily; in some cases smaller and more numerous meals seems preferable.

By giving breast milk we try as far as possible to protect the infants against the danger of infections. As a further precaution, the cases with pyloric stenosis are always placed in one of the smaller rooms of the hospital and precautions are taken to prevent their being exposed to infections, which, in the main wards, never may be altogether avoided.

These are the therapeutic and prophylactic measures which we believe to be the most important in the medical treatment of pyloric stenosis. According to our experience other therapeutic measures play only a secondary rôle. In a few cases, stomach washings seem to have had some effect, but in most cases, where they have been tried, they have not at all influenced the course

of the disease. The same may be said of the drugs, atropin, cocain and others, which have been given in a number of cases. Papaverin, lately recommended in the German pediatric literature, we have as yet tried only in a few cases and are therefore not able to form any opinion as to the effect of this drug.

The mortality in pyloric stenosis at this hospital (3.5 per cent.) is lower than in previous reports of non-operated cases. The surgical treatment may shorten the duration of the disease, but it has the disadvantage that good results seem to be obtained only by specially trained operators. In such localities, where the necessary skill is impossible to acquire because of the scarceness of cases, medical therapy must be employed and may, as seen above, in respect to the prognosis of the disease, be equal to surgical treatment.

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RAPID GROWTH OF ABNORMALLY SMALL CHILD (The Lancet, Sept. 10, 1921). The child described by Davidson weighed 1 pound 6 ounces at birth. The pregnancy was of about thirty-two weeks duration. For the first forty-eight hours the child was fed hourly with small quantities of a whey and cream mixture (3 ounces in twenty-four hours) and on third day feeding with breast milk was commenced. The child was laid to breast at feed times from birth as a routine although too weak to suckle. Immediately after the establishment of lactation on third day breast pump was used and breast milk so withdrawn was given to child by pipette or spoon 1 dram, every two hours, for first few days—increased in three weeks to 6 drams, every three hours. At the end of the second week, the child weighed 1 pound 14 ounces; end of third week, 2 pounds 10 ounces; end of fourth week, 3 pounds one-half ounce.—*Journal A. M. A.*

# THE EFFECT OF COMPRESSED YEAST CAKE IN INFANT FEEDING.\*

BY MAYNARD LADD, M.D.

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Boston.

We may accept as a general statement that the food for an infant must have the 3 known vitamins, that is (a) fat soluble A; (b) water soluble B; and (c) antiscorbutic vitamins, and these must be present in sufficient amounts. We may add as a corollary that it is no less important to have sufficient amount of fats, carbohydrates, protein, mineral matter and water to meet the individual requirements of the child. Intelligent feeding presupposes that the physician has clearly in mind all these requirements when he undertakes to prescribe a substitute food for an infant. It may be said also that infant feeding has reached such a point, that it is a rare exception when a normal baby cannot be successfully reared on cow's milk properly adapted to its individual needs.

A large amount of experimental feeding has been carried out on the lower animals to determine the part that is played by these 3 vitamins in the general problem of nutrition, and this has contributed many practical suggestions to the principles of infant feeding. But there is a possibility that the conclusions reached in the feeding of rats, guinea pigs, fowls, dogs and pigs may be applied too directly to infants. Milk is not a natural food for these experimental animals, except for a very limited period, if at all. Obviously, experiments on the lower animals must be repeated and checked on human infants, before their results can be accepted as practical for purposes of infant feeding.

Osborne and Mendel of Yale University, for example, in connection with their extensive investigations on growth, have shown very clearly that their experimental animals (rats) fail to show normal growth when milk was added to their diet, whereas with a small amount of yeast, normal growth followed. There is much evidence of a similar nature in the work of other investigators. The question that I had in mind in the 10 cases

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\*Read before the 33rd Annual Meeting of the American Pediatric Society, held at Swampscott, Mass., June 2, 3 and 4, 1921.

here reported was to determine whether the addition of such an accessory as yeast, which presumably is rich in water soluble B vitamins, would favorably influence the development of infants in the first year, or very undernourished babies in the second year, the other factors being managed along the lines of rational feeding.

It is obvious to anyone reading the advertising columns of some of our medical journals, that certain commercial firms, of a medical or semi-medical nature, are taking advantage of the present interest in vitamins, to put into the hands of physicians and of the public generally, products which, on the basis of animal experiments, are recommended as valuable growth promoters for the human infant. The danger, as I see it, is that the attention of the general practitioner will be directed away from the principles of sound and scientific feeding, in the hopes that a few pellets supposed to contain the essential vitamins, or the daily ingestion of a yeast cake will solve the problem of a difficult feeding case. An infinite amount of harm may result to the artificially fed infant if physicians attempt by such means to work out their feeding problems.

One does not undervalue the brilliant work that has been done in the laboratory in experimental feeding, but it is a fact that many physicians are neglecting the common-sense of infant feeding in their faith that there is a get-fat-quick method, embodied in the use of so-called vitamins, marketed under high sounding names.

In the cases here reported we have tried to determine only, whether the compressed yeast cake added to the food, which has been prepared and adapted as intelligently as we know how, had any special value as a weight producer. These babies were all hospital cases, were the so-called difficult class of feeders, and were carefully observed for varied periods. The weight charts all give evidence of satisfactory development, but careful analysis of the rate of weight development, during the periods with yeast and without yeast, do not show any benefit that could be attributed to the yeast itself, separate from the factors entering into the feeding problem.

As to the value of yeast in cases of acne and furunculosis, this series of cases gives no definite evidence. One case devel-

oped furunculosis while taking the yeast, obviously from contact with a baby similarly affected, and in that case it had no prophylactic value. The only ill effects from the yeast was seen in one baby who developed a severe fermental diarrhea soon after the yeast was begun, but when this was corrected, it later took a smaller dose ( $\frac{1}{2}$  cake), dissolved in boiling water, with no bad effects, but still without benefit to its nutrition.

In all cases but 2, a full yeast cake was given, being evenly divided in the day's feedings; in the 2 very young babies, one-half of a cake was given.

The results may be briefly summarized as follows:

Case I Parmo. Age 1 month.

Without yeast, 12 days, gained 16 ounces

With yeast, 12 days, gained 6 ounces

Without yeast, 15 days, gained 5 ounces

With yeast, 21 days, gained 15 ounces

Without yeast, 32 days, gained 26 ounces

Average gain, without yeast, 0.80 ounce per day

Average gain, with yeast, 0.63 ounce per day

Result. No benefit resulting from the yeast.

Case II Antonovitch. Age 10 months.

A long period of 50 days with a net loss of 4 ounces; a difficult-feeder, with rectal fissure and repeated infections of upper respiratory tract. She began to gain in weight before the yeast was used. The observations during the periods of the experiments were as follows:

Without yeast, 14 days, gained 20 ounces

With yeast, 28 days, gained 26 ounces

Without yeast, 56 days, gained 56 ounces

Average gain, without yeast, 1.08 ounces per day

Average gain, with yeast, 0.93 ounce per day

Result. No benefit resulting from yeast.

Case III Robey. Age 2 months.

Without yeast, 12 days, gained 8 ounces

With yeast, 12 days, gained 8 ounces

Without yeast, 24 days, gained 27 ounces

With yeast, 4 days, gained 9 ounces

Average gain, without yeast, 0.97 ounce per day

Average gain, with yeast, 1.06 ounces per day

Result. This case showed a slightly greater rate of gain on yeast, but only in the last period, and that of so short duration that its significance is not conclusive.

Case IV McCarthy. Age  $4\frac{1}{2}$  months.

A very difficult feeding case, with pylorospasm, a negative Wassermann, but a family history of syphilis in both parents.

Without yeast, 60 days, gained 27 ounces  
(previous to experiment)

Without yeast, 8 days, gained 4 ounces

With yeast, 8 days, gained 4 ounces

Average gain, without yeast, 0.45 ounce per day

Average gain, with yeast, 0.50 ounce per day

Result. The periods of equal duration with and without yeast showed the same rate of gain, and was practically the same as in the first 60 days without yeast.

Case V Richards. Age 2 months.

Without yeast, 57 days, gained 26 ounces

With yeast, 57 days, gained 46 ounces

Without yeast, 30 days, gained 17 ounces

Average gain, without yeast, 0.48 ounce per day

Average gain, with yeast, 0.80 ounce per day

Result. One of two cases in the series showing a considerably greater rate of gain while on the yeast.

Case VI Devlin. Age 2 months.

Without yeast, 70 days, gained 21 ounces

With yeast, 35 days, gained 20 ounces

Without yeast, 15 days, gained 10 ounces

Average gain, without yeast, 0.36 ounce per day

Average gain, with yeast, 0.57 ounce per day

Result. One of two cases in the series showing a considerably greater rate of gain while on the yeast.

Case VII Sheehan. Age  $6\frac{1}{2}$  months.

Without yeast, 26 days, gained 22 ounces

With yeast, 26 days, gained 16 ounces



Without yeast, 56 days, gained 41 ounces  
Average gain, without yeast, 0.76 ounce per day  
Average gain, with yeast, 0.61 ounce per day

Result. No benefit resulting from the yeast.

Case VIII Barassa. Age 13 months.

Without yeast, 43 days, gained 54 ounces  
Without yeast, 29 days, gained 40 ounces  
With yeast, 29 days, gained 39 ounces  
Without yeast, 38 days, gained 14 ounces  
With yeast, 34 days, gained 20 ounces  
Without yeast, 13 days, gained 12 ounces  
Average gain, without yeast, 1.00 ounce per day  
Average gain, with yeast, 0.92 ounce per day

Result. No benefit resulting from the yeast.

Case IX Fidler. Age 2 years.

Without yeast, 84 days, gained 23 ounces  
With yeast, 49 days, lost 24 ounces  
Without yeast, 60 days, gained 50 ounces  
Average gain, without yeast, 0.50 ounce per day  
Average loss, with yeast, 0.59 ounce per day

Result. The very unfavorable course during the yeast period in this case probably was not due to the yeast (*per se*), but to other factors connected with the feeding.

Case X Lentsos. Age 5½ months.

Without yeast, 28 days, gained 12 ounces  
Without yeast, 11 days, gained 10 ounces  
With yeast, 11 days, lost 17 ounces  
Without yeast, 15 days, gained 19 ounces  
With yeast, 52 days, gained 35 ounces  
Without yeast, 30 days, gained 21 ounces  
Average gain, without yeast, 0.73 ounce per day  
Average gain, with yeast, 0.30 ounce per day

Result. The loss of weight in the first period of yeast feeding was due to the development of a fermental diarrhea. This condition was corrected and the yeast administered after dissolving in boiling water. There was no further unfavorable effect, but

the subsequent gains in weight were the same, with and without the yeast.

*General Conclusions.* In only 2 out of 10 cases was there an increased rate of gain when yeast was incorporated in the infant food, and in these, other factors in the feeding probably accounted for the difference. In the other 8 cases, the yeast was apparently inert, with the one exception that when given raw, it produced a definite fermental diarrhea. There was no clinical evidence that the appetite or general condition of the babies were better during the periods when the yeast was given.

270 Clarendon St.

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HYPOTHREPSIA AND ATHREPSIA (Nourrison, Paris, Jan., 1921). Marfan recalls that growth is more active in comparison in the young infant than at any other period of life; the consumption of calories is nearly 3 times that of the adult per kilogram, and waste is thrown off in proportion. The smaller the infant, the greater its radiating surface in proportion to its weight, so that to keep its body at normal temperature it has to oxidize more substance per kilogram than the adult. When nutrition is insufficient, the child ceases to increase in weight; its adipose tissue disappears; there is autophagia of proteic elements, loss of water and of mineral substances, and this hypothrepsia may progress to incurable athrepsia. The causes may be from defective feeding, pathologic conditions in the digestive tract, or from infectious conditions, their action supplemented by inherited taints, unhygienic environment, and the lack of the stimulating action from the mother's smile and notice and crooning. Even in adults, the appetite wanes in dreary surroundings. The hypothrepsia of the infant may be the only sign of inherited syphilis. Extremes of temperature favor it, as also the environment in an asylum or other institution. But, he adds, hypothrepsia does not entail athrepsia, the incurable degree of denutrition, in the breast fed. In the artificially fed, the hypothrepsia may progress to athrepsia even after the primary digestive disturbance has subsided. The insignificance of the initial digestive disturbance in proportion to the final degree of denutrition has often been commented on.—*Journal A. M. A.*

## CLINICAL DEPARTMENT

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CASE CONTRIBUTED BY

MURRAY H. BASS, M.D., New York

CASE No. 18.\* Male, 4 months old.

*Personal History.* Jack M., first child, Italian parentage, born June 4, 1920, was first seen by me on September 29, 1920, when almost 4 months old. Mother has had no miscarriages. The child was born after a difficult labor in which forceps were necessary. No further details could be secured owing to the ignorance of the parents. The child breathed well and no abnormality was noted for about 2 weeks when the parents noticed that the baby failed to move its arms and that he held them in a peculiar position. This condition continued unchanged to date. The baby was breast fed, weighed 6 pounds at birth, and had gained slowly, weighing 10 pounds at 4 months. The history otherwise was negative.

*Physical Examination.* Somewhat pale male infant. Lies quietly on his back. When disturbed, kicks legs vigorously and cries loudly. Signs of mild rickets are present. The fontanelle is 3 fingers wide. There are no craniotabes. Ribs show mild beading. Heart and lungs are normal. Abdomen somewhat prominent. Edge of liver is felt one finger's breadth below free border of ribs. Spleen is not palpable. Lower extremities move well. Knee jerks are normal. The baby holds its upper extremities abducted from the body, in such a manner that the elbows are almost level with the ears. The elbow joints are both flexed at a right angle and the hands hang flail-like from the forearms. On pricking the hand with a pin the baby tries to pull the hands away by continued flexion of the elbow and abduction at the shoulder. The fingers of the left hand can be moved a little; those of the right hand apparently are completely paralyzed. There is some atrophy of muscles of hands and forearms.

The child was referred to the Pediatric Service of Mt. Sinai Hospital for observation. A radiogram showed normal bony structures of chest and upper extremities. Blood and urine

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\*Bilateral brachial birth palsy: lower arm type.

examinations showed no abnormality. The Wassermann test was negative. The diagnosis of bilateral birth palsy of upper extremities was made, the lower cervical and first dorsal roots being involved.

*Course of the Disease.* December 17, 1920; aged 6 months, weight 13 pounds 2 ounces. The baby apparently does not see; pupils dilated; eyes move aimlessly. Fundus examination by Dr. K. Schlivek: child is blind. Both discs are pale in the upper quadrant. Diagnosis: hemorrhage in the optic tracts somewhere anterior to the occipital lobes.

March 31, 1921; aged 9½ months, weight 16 pounds. General condition is good. Fontanelle, 3 fingers wide. No cranio-tabes. Baby can abduct arms. Right wrist is still flail-like, without any voluntary motion. Biceps apparently quite strong.

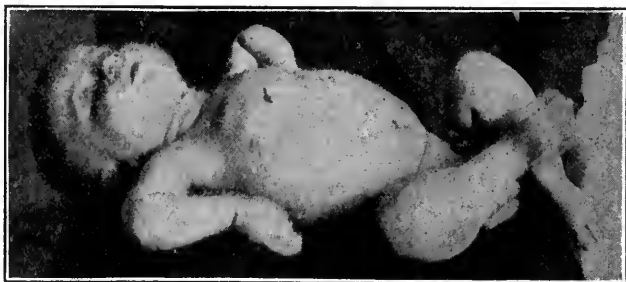


FIG. 1. Bilateral Brachial Birth Palsy. Lower Arm Type.

Hand can be pronated but not supinated. Apparently no motion whatever in the fingers. Fingers of left hand show considerable motion, both in flexion and extension. Both arms are beginning to show contractures at the elbow. Apparently the optimum position is with elbows on level of ears, with the hands approximated to the axillae. (See illustration.) The baby is now beginning to hold up its head.

This case is reported on account of the rarity of the condition found. We are dealing here presumably with a birth paralysis of the upper extremities, bilateral in character, and affecting chiefly the lower arm muscles.

There are 2 main varieties of arm birth paralysis depending on which nerve roots have been subjected to injury, viz: first,

an upper arm type depending on injury of the 5th and 6th nerve roots; and second, a lower or whole arm type in which the 7th and 8th and perhaps the 1st dorsal are also involved. This latter variety may moreover appear as a purely lower arm type (rather than a whole arm type) where the 5th and 6th roots escape, and the disease is limited to the lower cervical and 1st dorsal nerve roots, or the part of the plexus which they form. This is known as Klumpke's paralysis and is characterized by involvement of the small muscles of the hand, some of the muscles of the forearm and occasionally of the triceps.

In very rare instances this condition may be bilateral. The involvement of this particular group of muscles results in the very characteristic attitude assumed by the infant. As may be seen in the illustration, the upper arm is held abducted by the contraction of the deltoid while the lower arm is flexed on the upper by the unopposed action of the biceps. The hands hang flail-like and there is practically no motion in the fingers. When pricked with a pin, the baby cries and attempts to pull its hands away by continued abduction of the upper arm and flexion of the lower arm. The muscles involved in the paralysis are chiefly the pectoralis major, triceps, and all the muscles of the forearms and hands.

This identical condition has been described, first, by Jolly\* (Charité Annalen, Vol. 21, 1894-95) and later, by J. J. Thomas (Boston Medical and Surgical Journal, Vol. CLIII, No. 16, October 19, 1905.) The former reported a single case, whose description exactly tallies with my case. Thomas has collected 16 cases from the literature in which birth paralyses were of the lower arm type. Of these, 4 showed unilateral involvement, and 12, bilateral. Of the bilateral cases, all occurred in breech presentations except that of Jolly which was a face presentation. Thomas' cases were both face presentations. Both Thomas and Jolly conclude that the paralysis is probably the result of stretching of the neck due to the exaggerated lordosis produced by the presentation of the face.

Sever (American Journal of Diseases of Children, 1916, Vol. 12, p. 541) has reported a series of 471 cases of birth paralysis,

\*A good illustration of Jolly's case may be seen in H. Oppenheimer, Text Book of Nervous Diseases, translated by Bruce, 1911. Vol. 1, p. 437.

of which only 9 were bilateral. Of these, 2 were of the upper arm type and one of the lower or whole arm type. In the other 6 cases, the type was not noted. The rarity of bilateral lower arm birth palsy may be gathered from the above statistics.

Beside the disturbances in its extremities the infant described above also showed ocular involvement. The baby was blind, showing aimless movements of the eyes. The fundi were somewhat pale, especially the upper quadrant of the disc. The pupils failed to react to light. Dr. K. Schlivek, to whom the child was referred, considered the probable lesion a hemorrhage in the optic tract somewhere anterior to the occipital lobes. This lesion can also be ascribed to the trauma inflicted to the head during labor.

*Prognosis.* The prognosis for recovery from the paralysis in the condition described is bad, the few reported cases showing very little improvement as the children grew up.

MURRAY H. BASS.

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GASTROINTESTINAL HEMORRHAGE IN THE NEW-BORN (*Médecine*, Paris, Aug., 1921). The child may have swallowed blood during delivery or the blood may be traced to a crack in the nipple, and certain drugs may turn the stools black. If syphilis is responsible for the hemorrhage, mercurial inunction, etc., are effectual but slow. Rocaz advocates subcutaneous injection of 1 cg. of neo-arsphenamin per kg. of weight twice a week. He gives 0.15 c.c. in 1 c.c. of a 0.01 per c.c. solution of procain, suspending for fifteen or twenty days after a series of twenty injections. If laboratory tests show normal bleeding time and very slow coagulation, 10 c.c. of horse serum or diphtheria antitoxin or fresh human serum or citrated whole blood can be injected into a vein or cranial sinus or subcutaneously. Every five or six hours 15 or 20 c.c. of blood can thus be injected until the hemorrhage stops. The infant must be kept still, to ward off syncope, and be kept warm with hot water bottles or in the incubator. For stimulants, camphorated oil and ether may be useful, and 20 or 30 c.c. of physiologic saline daily, by the rectum or subcutaneously. Regular feeding should not be resumed until certain that the hemorrhage is over. Then the child rapidly recuperates.—*Journal A. M. A.*

## SOCIETY REPORTS

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### THE NEW YORK ACADEMY OF MEDICINE.

#### SECTION ON PEDIATRICS.

*Stated Meeting, Held March 10, 1921.*

MINER C. HILL, M.D., *in the chair.*

#### INTRACTABLE INSOMNIA AND PSYCHOSIS.

(Acute Epidemic Encephalitis)

DR. SIDNEY V. HASS presented this patient, Eleanor K., born January, 1917. The child had always been well until about February 20, 1920, when, for the first time, sleep was interrupted by what seemed to be a nightmare. Great difficulty was experienced in getting her back to sleep. After that she awoke once or twice each night crying as if in pain, but said "nothing was the matter." In March, the insomnia increased, the hour of falling asleep growing later each night. With great difficulty she was kept awake all day, only to stay awake until the usual sleeping time arrived. When sleep did come it was uninterrupted even by a loud noise or by moving her from bed to bed. She desired to go to bed about 8 P. M. but would rarely get to sleep before 4 A. M., making real efforts to do so, but without avail. For a time she would lie with her knees drawn up to her abdomen and lie face down, then with her knees drawn up would lie on her back, but was unable to sleep. This continued with increased severity until by July, the time for falling asleep was as late as 7 A. M. with few exceptions. There has been a gradual recession from this hour, until at the present time she falls asleep between 2 to 3 A. M. The number of hours of sleep in 24 hours varies greatly, at first 10 to 12 hours, beginning at 3 A. M. During June and July, the average was 6 hours, beginning at 7 A. M.; since that time, about 10 hours, commencing at 2 A. M., being interrupted 5 to 7 times during this period. The sleep is deepest from 7 A. M. until about 1:30 P. M. The longest waking period was 37 hours, from one Satur-

day noon to 1 A. M. Monday morning, followed by 2 hours of sleep, then 3 wakeful hours. Peculiar manifestations which varied somewhat from time to time accompanied the insomnia, such as persistently buttoning and unbuttoning buttons, pinning and unpinning safety pins wherever found. Early in the course of the disease she was engrossed in making beds and rearranging the bed clothes, sheets, blankets, etc. careful to get everything even and regular, spending hours at this. Somewhat later curtains and shades would be tampered with, after all other members of the family had gone to sleep. Curtains would be knotted or torn into strips, window shades rolled and unrolled, torn, crumpled, etc. Hours would be spent at this. Still later she would empty all the bureau drawers and put the contents back in their place in orderly fashion. There were continued movements of the tongue and marked pica, biting the lower lip and drooling, so that for most of the time her chin showed a marked dermatitis. Rapid, forced breathing, as seen in children after violent exercise, began early and persists. These breathing spells which accompany all the above activities are only relieved by what the parents call a "blue attack" which will be described later. In the beginning, these attacks of rapid breathing were not very marked and would only come on after some prolonged activity. Since September, however, they have been more violent and precede all effort. They occur only rarely during the day except for half an hour after arising, but apparently are entirely uncontrollable after 7 P. M. These attacks of rapid breathing can be temporarily checked by diverting the attention of the child to some interesting subject or object, or by taking the child for a walk, but are resumed as soon as the diversion terminates. They invariably result in the so-called "blue attack," after which the child is very quiet.

The so-called "blue attacks" are really attacks of pseudo-tetany. They occur, as stated above, or when the child is crossed or disturbed. Apparently the first symptom is a spasm of the glottis, for the child seems to be crying without uttering a sound. This is followed by an intense cyanosis, which, beginning around the mouth, covers the face, and the child falls over or slips down in her place unconscious. There is then a marked opisthotonos, with an exaggerated carpopedal spasm. This lasts upward of a



minute, during which breathing ceases until asphyxiation relieves the spasm. She then lies quietly until further irritation, either on her own part or of her surroundings, produces a repetition. She has had half a dozen within an hour. These attacks were not at first recognized because they all occurred at night. She would awake with a crying spell and would fall over in bed, and it was only when they occurred in the daytime that they were really recognized. It is sometimes impossible to get sleep with fewer than 8 or 9 of these spasmodic attacks, being awake, calm and quiet but not sleepy.

A week of careful study in the hospital revealed nothing which was of diagnostic value. Physical examination has been practically negative. Blood calcium is not diminished; electrical reactions normal. It was not until the appearance of the article by Happ and Blackfan, in which 6 cases of a similar nature were reported, that it was realized what the condition really was. The absence of any febrile attack made it exceedingly puzzling. Evidently our conception of lethargic encephalitis must be utterly changed, for lethargy exists in only some of these cases. As has been suggested, the term epidemic encephalitis should be used. Treatment by means of packing, bromides, luminal, atropine and hypnotics, has been entirely without avail. The child's weight has suffered very little, but she has not made physical progress in the last year and is distinctly inferior to what she was before the beginning of this illness.

#### CERTAIN ASPECTS OF MEASLES.

DR. PHILIP M. STIMSON read this paper. (To appear in a later number of *ARCHIVES*.)

#### POST-DIPHTHERITIC DIAPHRAGMATIC PARALYSIS.

DR. HAROLD RUCKMAN MIXSELL read this paper. (Published in *Journal A. M. A.*)

*Discussion.* DR. HENRY W. BERG commented on the fact that it was rather exceptional to have such a mass of excellent material as they had listened to tonight presented in one evening. He said he wished to speak particularly of Dr. Mixsell's paper. Dr. Mixsell had selected one of the most interesting subjects

connected with diphtheria. Dr. Berg recalled that he had seen 2 children die of post-diphtheritic diaphragmatic paralysis in the Nineties. At that time diaphragmatic paralysis was not a rare precursor of death from diphtheria. He had intended to report these cases, but he did not have time to prepare the report, and being unable to get an autopsy he thought there might have been some other complications that might have been implicated in the result, so the cases were finally not reported. There were cases of post-diphtheritic diaphragmatic paralysis that gradually progressed from a unilateral to a bilateral phrenic nerve paralysis. It was important to recognize them while they were still unilateral, for if they progressed until they became bilateral phrenic nerve paralysees there was no chance at all for them. He recalled one patient in the Willard Parker Hospital 14 or 16 years ago, who had a very serious type of diphtheria and in whom epilepsy developed in from 4 to 6 weeks after the diphtheritic process appeared. He had a convulsive seizure followed by diaphragmatic paralysis, unilateral, from which, after a long siege, he recovered. It was difficult sometimes to recognize a post-diphtheritic diaphragmatic paralysis, but one of the most important early symptoms was a peculiar cough not of the nasal type, due to paralysis of the hypoglossal nerve; nor was it a laryngeal cough. It appeared as though the patient tried to cough and could not do so; it was purely a throat cough, superficial and not expulsive, in which the diaphragm did not in any way participate. The patient produced a hybrid cough because he could not use his diaphragm. That symptom occurred early in the unilateral stage, and if one was going to treat the condition that was the stage in which it must be done; otherwise the results were uniformly fatal.

Dr. Berg said he admired Dr. Mixsell's paper greatly and differed with it in only one point, that was the slight amount of importance attached to the use of strychnine by the reader. Strychnine injected over the diaphragm, where it would reach the diaphragm on the affected side, would do some good, not because it regenerated the phrenic nerve but because it stimulated the respiratory center. This might enable one to carry the patient along for 4, 5 or 6 days until the danger of post-diphtheritic paralysis of the phrenic nerve had passed by. There was

a point in connection with the case reported from the American Pediatric Society in which artificial respiration was used which might be mentioned, and that was that he had never known death from post-diphtheritic paralysis to be due to apnea. There was a paralysis of glosso-pharyngeal supplied muscles that interfered with swallowing and diaphragmatic paralysis causing inability to cough. As a result even a little mucus collected in the finer bronchi could not be expelled and the patient finally developed a pulmonary edema. How artificial respiration could yield results when the lung was drowning in its own mucus he could scarcely see. He did not see how very much could be accomplished by artificial respiration. This type of paralysis was one of the subjects that required a great deal more study in order to obtain the results that we ought to get in these advanced days of antidiphtheritic treatment.

#### OBSERVATIONS OF THE OCULO-CARDIAC REFLEX IN DIPHThERIA

DR. JESSE G. M. BULLOWA presented this study of 148 cases of the Dagnini-Aschner phenomenon in diphtheria and showed that a negative response occurred in 86 per cent. of the fatal cases, though it occurred in 13 per cent. of all cases. In 24 clinically severe cases, 37 per cent. showed a negative response. In 25 per cent. of the severe cases, this presaged death. In only one or 4 per cent. of the severe cases did death follow a persistently positive vagus phenomenon, and in this occurred from a pulmonary complication.

He also showed that vagus irritation caused change of rhythm as well as slowing of the heart, with extra auricular systoles and sometimes stand-still of the heart. Adrenalin did not interfere with the phenomenon, nor did atropin. The vagus response is sometimes exhaustible and sometimes brought out by summation of stimuli. Sudden death may occur in spite of the return of the vagus response. As a result of this study, Dr. Bullowa concluded that the so-called vagus deaths were due to paralysis of the sympathetic and in them the vagus is not paralyzed, but unopposed. Illustrative polygraph records were shown.

THE TREATMENT OF TOXIC SCARLET FEVER WITH INTRA-MUSCULAR  
INJECTIONS OF CONVALESCENT WHOLE BLOOD.

DR. A. ZINGHER recalled that in 1915 he had reported a series of 15 cases of toxic scarlet fever selected out of 900 admissions to the Willard Parker Hospital which were treated with convalescent whole blood. Of these 15 cases, 11 recovered and 4 died; 2 of the fatal cases were practically moribund at the time of treatment; the other 2 died of septic complications. In the 11 that recovered, the results following the intramuscular injections of convalescent whole blood were very striking.

After reviewing the literature of the subject, Dr. Zingher stated that he wished now to present a series of cases that were treated more recently, and to briefly outline the status of the subject at the present time.

As we lacked definite knowledge of the etiological agent in scarlet fever we had developed no antitoxin to combat the disease, but had had recourse to convalescent blood of scarlet fever patients. Since 1897, various investigators attempted to use small amounts of convalescent serum, but the method was not placed on a rational and practical basis until 1912, when Reiss and Jungman recommended the intravenous use of larger amounts, 50 c.c. of pooled convalescent serum, which was given intravenously and, if necessary, repeated. R. Koch reported a somewhat larger series (22 cases) treated in the same manner in which he obtained excellent results. In 1918, Weaver reported 19 cases of toxic scarlet fever treated with convalescent serum. Of these one died. He stated that he obtained unexpected and striking recoveries in cases that seemed to have a very poor prognosis. Kling and Widfeld reported in 1918 a series of 237 cases treated with convalescent serum. In this group the observers reported a mortality of 10.5 per cent. as compared with a control group in which there was a mortality of 70 per cent. Ker reported in the last edition of his excellent textbook on infectious diseases very favorable results in cases of toxic scarlet fever treated with whole convalescent blood.

Dr. Zingher reported this evening a group of 3 cases of very toxic scarlet fever treated with the convalescent blood obtained from the same donor. These cases were treated by the method

recommended by Dr. Zingher in his first report in 1915. The method differed from those previously employed in that the whole convalescent citrated blood was injected intramuscularly in quantities of 4 ounces in children under five years of age, and 6 to 8 ounces in older children. The blood is obtained with a one ounce Record syringe and citrated by adding it to a 10 per cent. sodium citrate solution in proportion of 31 c.c. of blood to 1 c.c. of the citrate solution. The blood is injected in half to one ounce amounts intramuscularly into both calves, outer region of both thighs, both gluteal regions, both deltoids, and, if necessary, below the angles of both scapulae. The blood was rapidly absorbed and left no painful reaction behind. The clinical symptoms began to improve a few hours after the injection. There is a very rapid and critical drop in temperature, marked improvement in the cyanosis, pulse rate, nervous symptoms and general condition of the patient. This marked and striking change must be definitely associated with the injections, but in order to get these results there should be as early and prompt a use of the convalescent blood as possible. The 3 cases recently treated by Dr. Zingher represented in a striking way the effects of the injection of the convalescent blood. The first patient, a girl of 11 years of age, was admitted to the hospital on the third day of the disease. The next day her temperature was 106.6°. The intramuscular injection of 120 c.c. of convalescent blood (from a donor 7 days convalescent) resulted in a drop in temperature within 18 hours to 99° with a marked improvement in the symptoms, although the pulse remained high, between 120 and 140. The temperature rose to 102° the following day, but came down to normal again. About the tenth day after admission to the hospital, the patient developed an ear discharge and mastoid tenderness on the right side. The tenderness subsided, but soon returned. Three weeks later the patient developed an acute nephritis with degeneration of the cardiac musculature and finally died with an acute dilated heart.

The second patient, a boy  $3\frac{1}{2}$  years of age, was admitted on the first day of illness with an intense rash, active delirium, and a temperature of 105.2°. The temperature remained at 105.4° the following day, when the patient received 120 c.c. of convalescent blood (from a donor 13 days convalescent). The tem-

perature dropped by crisis within 36 hours to 99°. It then remained normal. There was an associated rapid improvement in the other symptoms and general condition of the patient.

The third case, a boy 6½ years of age, was admitted on the third day of illness. When seen the following day the temperature was 105.6°, the patient was unconscious and practically pulseless. In spite of the absolutely hopeless prognosis, 160 c.c. of convalescent blood was given intramuscularly (from a donor 22 days convalescent). The patient responded to the injection and the temperature dropped to 102°. At the time of the injection of the blood, there was a marked meningismus and the patient had considerable cough, although no definite pulmonary signs could be made out. Forty-eight hours after the injection of the convalescent blood, the temperature rose again to 106° and a bilateral pneumonia became manifest. The meningismus increased. Lumbar puncture showed a clear fluid under increased pressure. The patient died the following day, 72 hours after the blood injection.

These 3 cases illustrate in a striking way the beneficial effects of convalescent blood, even in a case as far gone and as moribund as the third one.

In the later septic cases Dr. Zingher recommended the use of normal citrated blood in similar amounts. Such normal blood could readily be obtained from a member of the family and would often show very beneficial results. Such results were due to the stimulating, nutritive and bactericidal action of normal blood.

*Discussion.* DR. H. R. MIXSELL said that the first case referred to by Dr. Zingher was seen by him in February on his service at the Willard Parker Hospital and he wished to say that it was a very toxic case. One might get the same results, however, with anti-streptococcic serum, or by the introduction of any foreign protein. It might be advisable, therefore, to check up on these results, for it was well known that some of these toxic cases improved very rapidly without treatment. One would see them very ill one day and the next day the temperature would have dropped and they would appear practically well. On account of this, it seemed to him to be very hard to tell whether or not it was the convalescent blood serum which had caused the

improvement, or whether these cases would have gotten well without it.

Dr. Zingher stated that it was just in these toxic cases that the convalescent blood was most effective. He had given the blood in cases selected for their poor prognosis. The streptococcus serum had been used in cases of scarlet fever since Moses had recommended it. At the Willard Parker Hospital it had been given occasionally, but any reaction observed was mostly due to the effect of the serum as a foreign protein.

THE ISOLATION OF A NEW MICROORGANISM IN SCARLET FEVER  
DURING THE EPIDEMIC OF 1920 AND 1921.

DR. J. C. REGAN, DR. C. W. H. CHENEY, and DR. B. WILSON presented this preliminary report, based on a study of 375 cases of scarlet fever admitted to the Kingston Avenue Hospital, Department of Health, from October 1920 to March 1921. They stated that the clinical picture presented by the patients in this epidemic was different in many respects to that which they had seen for several years past. Atypical forms of the disease had been more common and the ration of cardiac, respiratory and nephritic complications had been aggravated. It was therefore decided to make a bacteriological study of the blood, of the angina, of the seropurulent rhinitis, and of the various complications, to determine what microorganism was occurring in the cases this year.

After reviewing the history of previous investigations into the bacteriology of scarlet fever, the writers stated that the microorganism which they had found with striking frequency in their cases they had not found heretofore described either under the bacteriology of scarlatina or in the standard text-books. By reason of its morphology, cultural characteristics, agglutination reactions, animal susceptibility, and the type of lesions it produced in man, they believed this organism was a streptococcus but of a type apparently not previously described. At the same time in its morphological appearance it oftentimes presented a close resemblance to the meningococcus and the gonococcus. They had therefore named it a meningo-streptococcus in their routine bacteriological reports.

Morphologically, in direct smears from exudate, the micro-organism occurred as a coffee bean shaped diplococcus, about the size of a meningococcus or a little larger, occurring usually singly or in short chains of 3 or 4. The staining reaction was gram negative, but not strongly so, especially in carbohydrate broth. The organism lived well at room temperature. It had retained its vitality in the incubator, in broth, until the present time, for a period of about three months. Fairly good growth had been obtained on ordinary media (potato, milk, Loeffler's blood serum, gelatin, agar), but the diplococcus grew best on blood agar media and on glucose broth. Growth with acid production but no gas formation occurred in the following sugars: glucose, maltose, levulose, saccharose, lactose, mannite, dextrin, and galactose. Inulin media was not coagulated, and neutral red was not reduced. Indol was not produced. Milk was not coagulated although slow, gradual acidification occurred (litmus milk). In broth, cloudy flocculent growth occurred in 24 hours; while in 48 to 72 hours, a pellicle of fine characteristics began to form. Gelatin was not liquified but slight growth occurred in 48 hours. No pigment was produced on potato media, but pale almost invisible coalescent colonies developed slowly. On blood agar in 24 hours, fine discrete rounded colonies appeared along the line of inoculation, definitely opaque and elevated, which in 24 hours fused to form a characteristic type of growth of a peculiar whitish gray color. Microscopically the colonies were granular with smooth edges. The organism had peculiar hemolytic properties according to its virulence and the age of the culture. It was not agglutinated with antimeningococcus serum even in low dilutions. With polyvalent anti-streptococcus serum there was partial agglutination in dilutions of 1-60; complete macroscopic but Brownian movement remained microscopically in 1-40 while in 1-20 there was complete agglutination microscopically and macroscopic. White mice succumbed rapidly (24 hours) to intraperitoneal inoculation of  $\frac{1}{2}$  c.c. of fresh broth cultures. Two guinea pigs had been inoculated intraperitoneally, one with a virulent culture and the other with an attenuated culture. The former died within 48 hours and a meningo-strep-



tococcus was recovered in pure culture from the viscera and blood, while the latter, after several days of illness, recovered. Further work on animals was to be carried out.

The meningococcus was an aerobic organism with facultative anaerobic powers. It was non-motile, non-spore-bearing, divided in one plane and did not possess a capsule either in direct smears of exudate or in cultures.

The organism did not commonly grow either in the human body or in artificial media, in symbiosis with any of the pathogenic bacteria. It was usually isolated in pure cultures.

The writers described in detail the points in which the meningo-streptococcus differed from other pathogenic bacteria, notably the meningococcus, gonococcus, micrococcus, catarrhalis, rare gram negative diplococci, and the various known pathogenic streptococci. While resembling in smear morphology closely the meningococci and gonococci its distinction from them was evident from the cultural standpoint as well as its agglutination reaction, and animal pathogenicity. It differed from other streptococci by its morphological biscuit-shaped appearance, by its staining reaction, by the similarity of its cultures on various media, by not coagulating milk, by not reducing neutral red, and finally by its fermentation reactions.

In scarlet fever the microorganism had been found in 45 of 50 blood cultures, in all of 50 angina cultures, in 3 mastoid cultures (at operation), in 3 cervical adenitis cultures, in 8 cultures in abscesses in various parts of the body and in 11 vaginal cultures. The organism recovered from the blood and from the nose and throat, in the various complications were considered identical on the basis of morphological, cultural and agglutination tests.

In conclusion, the writers stated that they believed this organism had a great deal to do with the complications of scarlatina which were occurring during the present epidemic. They did, however, wish to emphasize that they had no idea of claiming it to have any etiological significance. This latter was rendered extremely improbable by the fact that it had been isolated in other conditions. Thus the meningo-streptococcus had been recovered in a few influenza-like attacks, in septic sore throat, in pneumonia and empyema, and in several cases of meningitis

and vaginitis. Its occurrence in meningitis at once made evident how easily such cases could be confused with those of epidemic meningitis due to the meningococcus, as the two organisms could only be differentiated on cultural and agglutination tests, being similar in direct smears of exudate. Anti-meningococcus serum therapy was entirely ineffective in meningitis due to the meningostreptococcus. A similar resemblance existed toward the gonococcus in vaginal smears, making the diagnosis from morphology impossible. Further work, Dr. Regan said, would be published along these lines.

PRACTICAL VALUE OF SCHICK TEST AND TOXIN-ANTITOXIN  
IMMUNIZATION.

DR. W. H. PARK, DR. A. ZINGHER AND DR. M. C. SCHROEDER presented this paper, which was read by Dr. Park. He stated that as the result of 7 years experience they believed that every person would respond to the injection of the Schick test dose of antitoxin, if it was properly administered. It was found, however, that about 2 per cent. of those who should give a positive Schick test had failed to do so. This fact had been discovered by doing double Schick tests in a routine way. It seemed fair to assume that when about 5 per cent. of those who had given a negative Schick test would give a positive one at some later time, that this was due in whole or in part to an error in technique in the first injection or to a stronger toxin being used in the second one. They had found that many of the outfits delivered quite improper amounts of toxin. When an excessive amount of toxin was given too many positive reactions developed and, in delicate skins, too severe a reaction. These might exist for many weeks and undoubtedly caused a certain number to be unnecessarily injected with toxin-antitoxin. There was no question in their minds that the great majority of persons that once made normal antitoxin retained it for their lives. Their practice was to give the toxin in 0.2 of a c.c. instead of 0.1 c.c. because they had found it a safer method for the general practitioner. They had learned, however, that it was necessary to increase the amount of toxin by 20 per cent., because of the dilution. They believed that those places which reported frequent changes from positive to negative or vice versa had had

the misfortune to use toxins of different strengths. It seemed impossible to believe that the results obtained in over 50,000 cases should not be dependable. Speaking of the Schick positive cases that became immune and the persistence of the immunity, they had found that according to the balance of the toxin-antitoxin the results had varied. A large number of animal tests had shown that the mixture should be as near the toxic line as was absolutely safe. Two injections gave on the average 80 per cent. of immunity response and 3, about 90 per cent. A chart presented showed that the duration of this immunity was at least 5 years. Dr. Park stated that they had studied the question whether diphtheria occurred in negative Schick cases. This problem they had approached in two ways. Did diphtheria develop in children with a negative Schick due to antitoxin, and were there faulty Schick tests which gave misleading results? They had many grounds for believing that enough antitoxin in a child to give a negative Schick test would prevent the development of pseudo-membranous inflammation due to the diphtheria bacilli. Some of this evidence Dr. Park reviewed; for example they had not given diphtheria antitoxin to children showing a negative Schick test in their contagious disease hospitals who had been exposed to infection and no harm had resulted from this procedure. They also knew that cases which had had tonsillar patches along with negative Schick tests and positive cultures had not been given antitoxin and these cases had recovered in a similar manner to other cases having similar appearances but no diphtheria bacilli. On the other hand, they had met with two experiences in which exudative inflammations of the tonsils or of the tonsils passing over to the lateral walls of the pharynx, had developed in children with a negative Schick test. The most puzzling instance was in a home for orphans where in one room 8 cases of this kind developed in the course of 8 days. The 6 most severe of these cases had diphtheria bacilli. The 2 of less severity showed no diphtheria bacilli. The test of some 50 healthy children within this room and others in other rooms showed the remarkable fact that fully 50 per cent. of the children in all the rooms were at the time carriers of virulent bacilli. They had the remarkable fact that in another room, although many of the children were carriers, no diphtheria ever developed,

while in this single room, 6 cases developed a moderate diphtheria-like inflammation of the tonsils or of the tonsils and adjacent wall of the pharynx with bacilli and 2 a follicular tonsillitis without diphtheria bacilli. All the cases made good recoveries within 48 hours; the last two receiving no antitoxin and one of the others definitely starting to recover before the antitoxin was given. Antitoxin was given to the children in the ward but not to the children in the other rooms. No further cases developed in any part of the building. The 2 suppositions which seemed possible were that some infection was prevalent in the ward which caused these croupous cases of tonsillitis and that the diphtheria bacilli were present without producing lesions. Because of being so prevalent in all parts of the institution they would naturally be in their throats. The other was that because of some infection, such as the streptococcus, the children in this ward were subject to tonsillitis and the diphtheria being present in their throats grew in the exudate, produced endotoxins and exotoxins and thus added slight superficial lesions. The amount of antitoxin would be conceived as too small in amount to prevent contact irritation but would be sufficient to prevent general diphtheria toxemia. A local reaction might also be considered as due to the endotoxin of the diphtheria bacillus rather than its toxin. On either supposition, a case would recover as surely, though possibly not as quickly, without antitoxin because there would be no possibility of diphtheria toxemia because of the antitoxin circulating in the blood. After referring to experiences in other institutions, Dr. Park said that as evidence accumulated they found greater and greater ground for belief that in the toxin-antitoxin injections they had an extremely valuable immunizing agent which would greatly reduce the morbidity and mortality of diphtheria. Its effectiveness certainly lasted more than a year and probably lasted a lifetime. Two doses of 1 c.c. toxin-antitoxin produced immunity within 3 months in 80 per cent. of immunes. A second Schick test should be made at the end of 3 months, and, if found negative, should be reinjected. As the greatest danger of diphtheria was in children between 6 months and 5 years, the toxin-antitoxin should be given to infants as soon after reaching 6 months as possible. Infants before the age of 3 months did not respond to the injections of toxin-antitoxin.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION ON PEDIATRICS.

*Stated Meeting, Held April 14, 1921.*

MINER C. HILL, M.D., *in the chair.*

POLYMYOSITIS IN CHILDREN WITH X-RAY PICTURES.

DR. SARA WELT-KAKELS gave a comprehensive review of the literature of this subject in the course of which she mentioned that Dr. George W. Jacoby had called attention to the condition in 1888, but on the whole American literature contained very few contributions to the subject. A German authority, in 1912, collected 40 cases from the literature and called attention to the rarity of the condition. In the text-books the disease was not mentioned at all or received very slight attention. Its etiology was obscure, and though it was considered to be of infectious nature the organism had not been isolated. The disease had been suspected of being due to a protozoa but Pfeiffer had failed to find a protozoa in his study of the condition. The disease frequently followed on the track of acute infections, and again it frequently attacked without known cause previously healthy children. It seemed to predominate in the male sex.

Dr. Kakels said it had been her good fortune to have seen 2 cases of this rare condition, and to have made an autopsy in one case, which was so far as she could find only the second study of the kind made in this disease. One of the patients, who made a complete recovery, she had presented before the Section. The other resulted in atrophy and contracture and died 2 years after the onset. In polymyositis the onset was characterized by malaise, severe headache and pain in the muscles and large joints, though the joints always remained intact. There was great pain on pressure and various groups of muscles became simultaneously or successively involved; few of the skeletal muscles escaped. As the disease advanced, various contractures appeared and were most pronounced in the extremities. There was considerable swelling caused by muscle infiltration and also by cellular edema. The skin became involved in nearly every case at the time of onset or later. Strumpfel had reported seeing a redness sug-

gestive of erysipelas. Dr. Welt-Kakels said that the case had shown the skin rash which was at first diagnosed as scarlatina and later looked like urticaria. In some cases there was stomatitis and tonsillitis. A splenic tumor had been noted in acute cases. There was no great difficulty in the differential diagnosis. Only 2 conditions had to be considered: trichinosis from which it could be differentiated by examination of the feces and eosinophilia; and multiple neuritis which was very rare in children. As to the prognosis, Steiner had analyzed 28 cases, 14 of which had died. Under microscopical diagnosis the muscle tissue showed a change in color and consistence and was infiltrated. The degree of change in the muscles was dependent upon the extent and severity of the disease.

#### X-RAY TREATMENT OF TONSILS AND ADENOIDS IN CHILDREN.

DR. W. D. WITHERBEE read this paper. (See ARCHIVES OF PEDIATRICS, September, 1921, page 592.)

#### ROËNTGEN THERAPY IN INTRATHORACIC LESIONS WITH SPECIAL REFERENCE TO STATUS THYMUS LYMPHATICUS.

DR. W. H. MEYER read this paper. (See ARCHIVES OF PEDIATRICS, September, 1921, page 572.)

#### DIFFERENTIAL DIAGNOSIS BETWEEN PNEUMONIA AND PLEURAL EFFUSIONS, AS SHOWN ROËNTGENOGRAPHICALLY.

DR. WILLIAM H. STEWART stated that the frequent difficulty in ascertaining the presence or absence of fluid in the pleural cavity or the early detection of consolidation, by physical signs alone, had prompted him to present this short communication, advocating what he believed to be the greatest of all aids, namely, the roëntgen examination.

The most common problem was the differentiation between empyema and pneumonia, since both give at times deceiving physical signs, especially in children.

Many theories had been brought forward to explain why normal or increased vocal resonance was occasionally encountered in cases of pleural effusion. What to him seemed the most reasonable among them was the explanation of Montgomery and Eckhart of Philadelphia. Based on a series of experiments, these

authors arrived at the conclusion that where the compressed lung retained air in the alveoli, as it did in the majority of cases of pleural effusion, there was a break in the transmission of sound at the junction of the aerated lung and the fluid due to a change of mediums; the air-borne sounds within the lung having to pass from air, a very light medium, to fluid, which was very much denser. This explanation, combined with the diffusion of sound through the fluid after it left the lung, seemed to account for the usual diminution of vocal resonance in pleuritic effusions. Working upon this basis, they attempted to explain that the normal or increased vocal resonance was due to the fact that the lung beneath the fluid was solid, either from compression or inflammation and that, consequently, there was no break in the transmission of sound from the bronchi to the chest wall, it having been proven that water itself was a good conductor of sound and that sound vibrations did not suffer greatly in intensity as they passed from solid tissue to water or from water to solid tissue. They also claimed that in this phenomenon the element of diffusion was very important, the loss of sound being for this reason greatly dependable on the distance of the lung, whether air-bearing or solid, from the chest wall. Even these fair minded observers concluded that their explanations did not always hold good.

Having shown reasonable theories for the lack of normal physical signs in pleuritic effusions, what were the facts in reference to lack of bronchial breathing and increased vocal resonance in cases of solid lung without fluid, such as pneumonia? Many cases of this lesion come under their observation which did not present the usual physical signs of consolidation until late in the disease; the common explanation being that these were central pneumonia.

Dr. Howard Mason, of New York, was the first to call attention to a feasible explanation why there was such a frequent lack of positive physical signs, such as bronchial breathing in some cases of pneumonia. He held that in all cases of pneumonia the consolidation touched the pleura at some point, that the disease usually involved one lobe, most commonly the middle right, that it had the appearance of a wedge with the base at the pleural surface, and the apex toward the root; that when there was nor-

mal lung between the root and the solid portion, thus providing a break in the conduction of sound from the bronchi to the surface of the lung, physical signs of consolidation would be missing; that, as the disease spread, the apex of the triangle gradually reached the root, at which time bronchial breathing became audible and the voice sounds increased. As many cases of pneumonia were believed to start at the root and spread toward the cortex, this explanation would seem to apply only to those commencing at the pleural surface.

Having shown the uncertainty that frequently existed in the diagnosis of pneumonia and in pleural effusions where one depends wholly upon the physical signs, he called attention to the certainty of the roëntgen findings, in these two lesions, the shadows being so characteristic that the roëntgenologist was able, in the majority of doubtful cases, to clear up the diagnosis at a very early period in the disease, in fact, long before positive physical signs appeared.

What, then, were these roëntgenographic findings? The character of the shadows cast by fluid in the pleural cavity depended entirely on the quantity and the presence or absence of pleuritic adhesions. The most common finding in a simple pleural effusion of moderate amount was a dense shadow occupying the entire chest on the involved side and extending upward from the diaphragmatic line with a cup-shaped, irregular upper surface. The size of this shadow depended, of course, on the quantity of fluid present. In children, however, even without adhesions, one might have a clear area of lung structure between the fluid and the root down to the diaphragm. This was especially so in the beginning effusions where the shadow of the fluid seemed to extend upward on the parietal pleura, before overshadowing the lung markings at the base. As the pleural cavity filled, and it usually filled rapidly in children, the distinctive cup-shaped upper border gradually disappeared until finally the entire side was occupied with a dense cloud of a consistent character which completely overshadowed the entire lung. This was usually associated with some displacement of the mediastinal contents to the opposite side, although this result occurred much more frequently in adults than in children.

If adhesions were present, the effusion might become encap-



sulated, in which case the dense shadow cast by the fluid usually appeared as a globular mass encroaching upon the lung structure, from the cortex toward the root, the base of this shadow conforming to the shape of the chest. This sacculation might occur high up or at the base; it might be anterior or posterior. In either case, the location could be most accurately ascertained by a stereoroëntgenographic examination.

When at the first examination a case presented a dense shadow occupying the entire chest, care must be taken to obtain a clear and complete clinical history, as a patient who has suffered from a former attack of pleural effusion, especially in empyema, might be left with a pleura sufficiently thickened to cast a shadow similar to that of a pleural cavity filled with fluid.

The shadows cast by a pneumonic process usually commenced at the cortex of the lung; in the early stage, being limited to one lobe, the most common was the middle right. The consolidation was generally wedge-shaped in appearance with the base at the pleural surface and the apex toward the root; it spread laterally and inward toward the root until finally the entire lobe was involved. There might be an extension into other portions of the lung, but even this extension usually spread in the same manner as the original lesion. The peculiar, wedge-shaped shadow found in pneumonia was quite characteristic and differentiated this lesion from an encapsulated pleuritic effusion. The latter had a sharp edge, circular in form, which extended inward from the corex and, in addition, the sacculation did not limit itself to one lobe.

Root pneumonia assumed a somewhat different course. The consolidation appeared as a dense, fan-shaped shadow spreading toward the periphery, the outer edge being very irregular. It extended from the hilus outward, involving more than one lobe; many cases did not reach the cortex.

Pneumonia was frequently complicated by an empyema. In such cases the roëntgenographic findings as to the presence or absence of fluid were most important, especially in a draining, suppurating pleurisy where there was a sudden rise in temperature which could not be explained. In such cases a roëntgen examination would usually reveal a consolidation above the drained area.

In regard to the unreliability of the chest tap, too many times do we see cases which, while presenting a clear clinical picture of pleuritic effusion supported by the roëntgenographic findings, give repeated negative taps; we all had seen cases of simple pleurisy with effusion converted into an empyema or pneumothorax by this procedure. Aspiration for diagnostic purposes was a valuable method of verification, but it must be performed by skillful hands and with all surgical precautions, after the fluid had been located by the roëntgen examination. The tendency to ignore surgical procedure on the mere evidence of a persistent negative tap, even though the clinical symptoms were those of an empyema, and the roëntgenographic findings clearly indicate fluid, must be overcome.

DIAGNOSTIC VALUE OF ROËNTGEN RAY IN THE DIGESTIVE TRACT OF  
INFANTS AND CHILDREN. WITH LANTERN SLIDES.

DR. L. T. LE WALD remarked that the question of technique was always important in dealing with x-ray examination of the digestive tract of infants and children. It was preferable that the examination be made on an empty stomach. The abdomen was inspected and palpated. Prior to the administration of the opaque meal a fluoroscopic examination was made. This was supplemented by one or more radiographs in order to have a record of these findings. Whatever food was given, it was advisable to observe fluoroscopically, at least part of it, pass through the esophagus and into the stomach.

A series of roëntgenograms was then made in both the vertical and horizontal positions. Further exposures were made from the third to the sixth hour, without the child's having had any additional food or drink, in order to determine the exact emptying time of the stomach. If retention were present further exposures might be made at the eighth or ninth hour. A further examination was made at about the twenty-fourth hour. Roëntgenograms were taken to determine how much of the meal had been eliminated, paying particular attention to the question of rectal constipation. At the forty-eighth hour the child was examined principally for stasis in the colon. If there was stasis in the colon or retention in the appendix, examinations were made daily until all traces of the meal had been eliminated.

The child was then given a cathartic followed by a simple enema. A radiograph was made to disclose whether or not the bowel was completely empty and to observe the presence of gas. An opaque injection was then given. Stereoscopic roëntgenograms were made in the prone position, followed by single or stereoscopic examinations in the vertical position. In unusual cases these were supplemented by oblique or lateral exposures. The child was then allowed to eliminate. The amount of retention in the colon and the condition of the ileocecal valve were noted in exposures immediately after elimination. An examination was made 24 hours after the injection to study the emptying of the colon, and observe the presence or absence of rectal constipation and retention in the appendix. This ordinarily completed the examination, but in unusual cases further study might be necessary. Consultation was then held with the attending physician or surgeon.

Dr. Le Wald illustrated his paper by means of lantern slides of typical cases of congenital atresia of the esophagus; cardio-spasm; congenital hernia of the diaphragm; intussusception; foreign bodies; syphilis of the stomach; duodenal obstruction; transposition of viscera; non-rotation of colon; megacolon slides were also shown illustrating the effect of posture in feeding of infants.

#### SYMPTOMATOLOGY OF STRUCTURAL ABNORMALITIES OF THE GASTRO-INTESTINAL TRACT IN CHILDREN.

DR. CHARLES GILMORE KERLEY stated that in different contributions during the past 3 years, the results of their observations on gastrointestinal disorders in children, depending primarily upon mechanical agencies, had been offered to the medical profession. Their x-ray studies of the gastrointestinal tract in chronic digestive disorders now covered a sufficiently wide field to allow them to draw certain fairly definite conclusions, and thus establish a correlation between an anomaly or an acquired abnormality and a symptoms complex.

The patients upon whom these studies were made were with few exceptions very much alike. They showed malnutrition and they had some persistent or recurrent gastrointestinal disorder, and came to them because of such an ailment.

In considering the symptomatology of the period, dilated stomach, gastropasm and pylorospasm Dr. Kerley pointed out that in the ptosed stomach there was a delayed emptying, largely because of the changed relations of the pylorus to the stomach proper. The ptosed stomach was elongated and in a vertical position and required a longer emptying period than the normally situated organ.

In the dilated stomach there was a defective muscular tone and hypermotility. The results in both conditions were very much the same—stomach residue—when the organ should be empty. Stomach residue after 5 hours caused two symptoms very frequently encountered, namely, (1) recurrent vomiting, and (2) a loss of appetite. Dr. Kerley said he had yet to see a residue case with a normal desire for food; they were those who had to be urged and stimulated to take food, particularly at the mid-day and evening meal. The recurrent vomiting in a residue case occurred at fairly regular intervals and the patient had usually been treated for acidosis.

Stomach colic and lesser stomach pains appeared always to be associated with gastropasm, exaggerated motility. In gastropasm they had found two causative factors—hyperacidity and pylorospasm. Not all cases of hyperacidity, however, had gastropasm or pain. This had been proven, Dr. Kerley said, by his co-worker, Dr. Edward J. Lorenz, Jr., in a series of cases that they had studied, by means of gastro-analysis. In those with the complaint of stomach pain they had found the condition of hyperacidity usually, hypermotility and pylorospasm invariably.

In the vomiting child, they had found that the vomiting, whether recurrent, habitual (daily) or occasional, was associated with the ptosed stomach, which was mechanically difficult of emptying and showed hypermotility, or with the dilated stomach with hypomotility, or hypermotility or pylorospasm, the last being a frequent indirect factor in causing an emptying of the stomach through vomiting, the spasm apparently being due to causes operative elsewhere in the gastrointestinal tract.

As an illustration, Dr. Kerley cited the case of a boy, 8 years old, who had been under their care for recurrent attacks of vomiting, the seizures occurring at about 2 months' interval.

On February 28, an unusually severe attack developed. The vomiting continued at frequent intervals for 10 days. At the commencement of the attack the child weighed  $71\frac{1}{4}$  pounds; in 11 days he had lost 10 pounds, weighing  $61\frac{1}{4}$  pounds. He was referred to Dr. LeWald for x-ray examination. A summary of Dr. LeWald's report indicated an extreme grade of pyloric stenosis, which, whether due to spasm or other origin, was sufficient to render surgical intervention necessary unless relieved by antispasmodics. The report further stated that there was elongation and spastic contraction of the colon. The ileocecal valve was incompetent. The spastic condition of the colon might be an important factor in the production of colonic stasis, and a remote cause for the pylorospasm and consequent vomiting.

Dr. Howard Barber had shown in some very instructive experiments in dogs that lesions and irritations on the lower intestinal tract would produce exaggerated stomach motility and pylorospasm. It had been their observation repeatedly that their cases of pylorospasm almost invariably were those which had abnormalities with retention at the cecum or some point in the large intestine or rectum. Later observation in this boy revealed the fact that there was rarely a complete evacuation. This had been demonstrated by the use of an enema shortly after a supposed normal evacuation had taken place. Fecal material had been found in the rectum by means of a digital examination one hour after an evacuation. The chart presented showed the rapid gain that occurred when this child could pass food through the pylorus.

Habitual intestinal colic or lesser pain they had found to be due to gas retention. Such gas retention occurred with sacculations, dilatations and angulations. Dr. Kerley cited a case of pronounced recurrent attacks of pain in the right lower quadrant, continuing over a period of 2 years, in a boy 11 years of age. A diagnosis of appendicitis had been made with recommendation for operation. The recommendation for operation had not been carried to a conclusion because there never had been pain upon pressure; there was an absence of spasticity of the right rectus. Rectal examination was negative and the blood failed to offer corroboration. A diagnosis of dilatation of the cecum seemed justifiable, according to their experience

with similar conditions. The boy was x-rayed by Dr. LeWald and the cecal dilatation was present. There was an acute colonic angulation immediately beyond the hepatic flexure. Abdominal pain, due to such cause, might be paroxysmal and severe or give rise to a feeling of abdominal discomfort, without localization, and had to be considered in its relationship to symptoms of chronic appendicitis.

Dilatations and sacculations were apt to be found in the cecum and sigmoid, particularly at the colonic-sigmoid junction.

Habitual constipation that resisted a proper diet and simple medication would usually be found to be dependent upon defective intestinal mechanics. They had had persistent constipation explained by ptosis of the colon, by angulations at different points, by elongated sigmoid and by dilated sigmoid. It was not claimed, however, that such conditions meant constipation.

Rectal constipation, where, though there was a daily evacuation, the rectum was never completely empty, was found in those with overactive anal sphincter. In the boy with pylorospasm, referred to above, feces were present 2 hours after a supposedly normal evacuation. This condition was in association with spastic colon.

They had found the explanation of persistent low grade fever, 100° to 101°, in defective bowel elimination, and this was to be thought of in such cases.

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ACUTE PERICARDITIS IN CHILDREN (*Médecine*, Paris, Aug., 1921). L. Baumel warns that a little nausea or vomiting may be the only symptom unless one notices that the pulse is weak and depressible and the heart sounds deep or at least attenuated. He is convinced that insidious pericarditis is far more common than generally supposed, and that it frequently follows left pleurisy with effusion. Administration of digitalis and iodid is important to ward off adhesive sequelae. He recently diagnosed adhesive pericarditis in a year old infant with a precordial murmur covering the entire revolution of the heart. There are also indications of patent ductus arteriosus, the cyanosis being congenital, while the pericarditis dates from the sixth month. The child's father has rheumatism and heart disease.—*Journal A. M. A.*

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# The Diagnosis of Nervous Diseases

By **SIR JAMES PURVES STEWART, K.C.M.G., C.B., M.D., Edin., F.R.C.P.**

Senior Physician to the Westminster Hospital; Physician to the Royal National Orthopedic Hospital; Consulting Physician to the West End Hospital for Nervous Diseases; Membre Correspondant de la Société de Neurologie de Paris; Corresponding Member of the Philadelphia Neurological Society; Colonel, Army Medical Service.

Seldom in practice are diseases met with in their fully-developed, so-called "typical" forms; more often patients exhibit signs and symptoms common to several diseases. This volume approaches the subject of diagnosis from the clinical standpoint, avoiding abstruse details of purely theoretical interest; treatment is not discussed save incidentally here and there.

Since the fourth edition of this work was published three years ago, the European War has happily come to an end. But even during the recent war neurology has not ceased to advance. Numerous new and important facts have been learned with reference to war injuries and diseases, whilst fresh problems have also arisen in civilian neurology, many of them yet unsolved. The present edition has been revised and in part rewritten. A short chapter upon war neuroses, regarded from the clinical standpoint, has been added, but without attempting to discuss the various metaphysical theories, more or less abstruse, propounded to explain them by eminent psychologists of different schools.

## SOME MEDICAL REVIEWS

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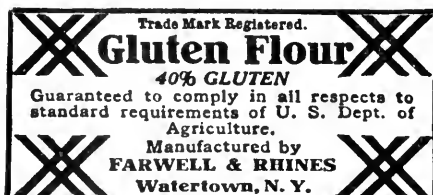
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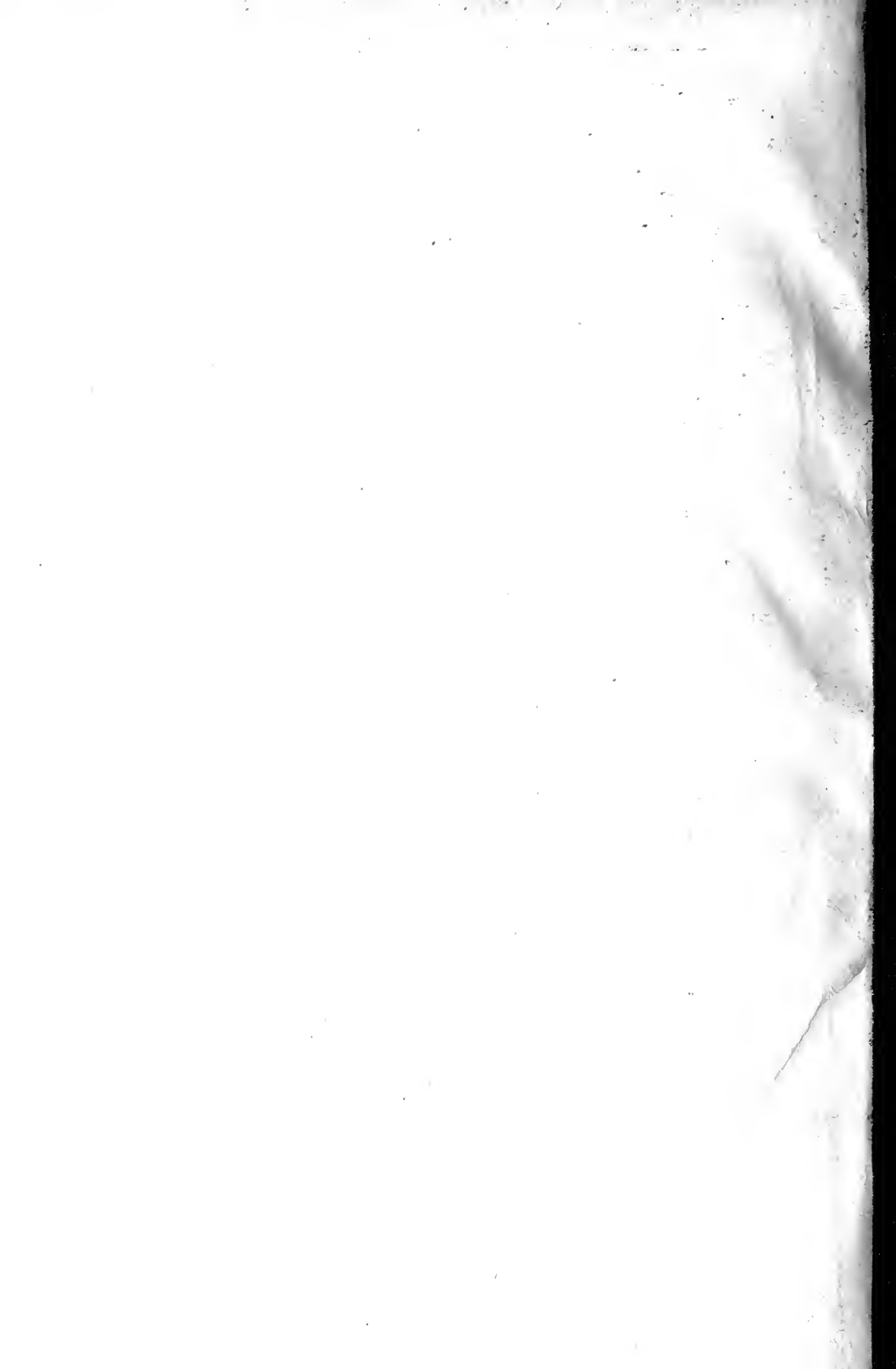
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